BIOGRAPHICAL SKETCH

Edmund M. Crane. Born in Port Jervis, Orange County, New York State, January 8, 1900. Attended elementary and secondary schools in Port Jervis to January, 1918. Enlisted January, 1918 in United States Army Air Service; discharged June, 1919. Graduated from Port Jervis High School June, 1920. Attended New York State College for Teachers at Albany, New York, 1921-25, graduated with B.S. degree. Attended summer school, New York University, 1926, Cornell University, 1930, Columbia University, 1932-34-35-38, receiving M.A. degree. Attended Cornell University, academic years 1940-41 and 1941-42.

Taught business subjects in the Gloversville, New York, High School, 1925-27. Supervising principal in the Wallkill, New York, Union Free School, then central rural school 1927-40.

Married Marjorie Wilson, August 30, 1935. They have one son.

ACKNOWLEDGMENTS

This study was conducted under the direction of

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

The first decade of the twentieth century found rural education in New York State lagging behind urban education; it failed to reach many farm children; its program was not comparable in quality to urban education; and its program failed to meet the immediate needs of farm and village youth. To provide improved educational opportunity in rural areas, centralization was enacted into law in 1914:

> "The commissioner of education is hereby authorized and empowered to lay out in this state in any territory exclusive of a city school district conveniently located for the attendance of scholars and of suitable size for the establishment of central schools to give instruction usually given in the common schools and high schools, including instruction in agriculture." Article 6B, Section 180, New York State School Law.

The permissive law of 1914 was not sufficient to bring about the desired improvements and in 1925 encouragement was given to centralization through special financial grants.

> "Any central rural district organized under the provisions of this article shall from the time of its organization receive from the state the same

> apportionments and quotas which a union free school district is entitled to receive under this chapter, and in addition thereto shall be apportioned and paid to such district the district quotas, teachers' quotas, additional teachers' quotas and equalization quotas . . . for each of the districts included in such central rural school district, in the same amount and under the same conditions as though such central rural school district had not been established and as though a school had been maintained in each of such districts included within such central rural school district." Article 6B, Article 185, New York State School Law.

Under the impetus of the 1925 law, centralization spread rapidly to such extent that in July 1941 there were in the state of New York 283 central rural schools.

The importance of transportation as an essential feature of rural education was early recognized, as was the state's responsibility for a share in the support of an adequate program. This is acknowledged in the education law as amended to 1932.

> "There shall also be apportioned and paid to each central rural school district established as herein provided a quota to be known as the transportation quota, equivalent to one-half of the sum paid for the transportation of pupils. . . .
>
> "The board of education of such central rural school district shall cause to be presented to the commissioner of education, in the manner and at the time required by him, a statement as to the amount expended by such district . . . for the payment of the cost of transportation.
>
> "The transportation . . . quotas provided for in this section shall not be apportioned and paid to such district unless it shall appear that the expenditures for school purposes during the year for which such quotas are apportioned, exclusive of public moneys, shall exceed a sum equivalent

to five mills on each dollar of the assessed valuation of the taxable property in such district." (Added by L. 1914, ch. 55, and amended by L. 1925, ch. 673; L 1926, ch. 299; and L 1932, ch. 431, in effect March 26, 1932.) 1/

With the expansion of centralization, transportation has been extended rapidly and the expenditures for transportation have assumed a major position in the rural school budget. This may be exemplified by the fact that in the school year 1939-40, 60 of the 283 central schools in New York State transported 21,123 pupils daily at a total cost of $726,540.82; an average of 352 pupils per district at a mean cost per district of $12,101.03.2/

There has, however, been a growing belief that the transportation law as written above has not adequately served the purpose of equalizing the burden of providing an effective transportation service. There are inequalities either inherent in the law or resulting from the manner of its application, as follows:

1. Because of the matching clause, districts with

1/The law above was that in effect when this study was begun. A new law going into effect July 1, 1942 has since been passed, which has for its purpose the determination of district needs by formula and allocation of funds in conformity with the equalization principle.

2/The 60 districts mentioned above are among those selected for the prosecution of this study. The manner of their selection will be described in Chapter III.

greater local resources are favored at the expense of those with scant local resources. That districts vary greatly in their ability to raise funds locally is readily demonstrable. The sixty districts aforementioned vary greatly in taxable real estate (full value) from $241,251 to $10,891,433. The taxable values behind each pupil transported in the 1939-40 school year varied from $1,915 to $40,811, with an average of $10,969. For purposes of comparison, the sixty districts were listed in the order of their taxable wealth per pupil transported, divided into five equal groups, and the average wealth of each group determined. (See Table I)

TABLE I

REAL VALUE PER PUPIL TRANSPORTED
IN 60 NEW YORK CENTRAL DISTRICTS, 1939-40

District groups	Average real value per pupil transported
1	$ 3,855
2	6,112
3	8,054
4	11,315
5	25,427

Low	$ 1,915	Mean	$10,969
High	40,811	Median	8,176

It is believed, however, that the number of pupils transported is not an adequate measure of

transportation costs and, consistently with this, that real value per pupil transported is not an adequate measure of a district's ability to provide transportation. A more realistic statement of varying abilities might be made by examining the real taxable value behind or supporting each dollar spent for transportation. In the year 1939-40 and in the same 60 districts, this varied from $34 to $1,208, with an average of $303. A table arranged in the same manner as that on real value per pupil transported follows. Examination of this table shows that one school had 35 times as much wealth behind each dollar spent on transportation as had the school at the other extreme; that

TABLE II
REAL VALUE PER DOLLAR EXPENDED FOR TRANSPORTATION IN 60 NEW YORK CENTRAL DISTRICTS, 1939-40

District groups	Real value per dollar expended
1	$102
2	171
3	222
4	337
5	681

Low	$ 34	Mean	$303
High	1208	Median	217

the schools in the fifth or highest group had six times as much taxable property in proportion to

transportation expenditures as had the schools in the first group; that is, that the schools of the first group were burdened six times as heavily as were the schools of the fifth group in carrying out the 1939-40 transportation program.

2. Because of the manner of distributing state funds, it is possible for a district to receive all of its funds for transportation from the state. The major state fund from which aid is distributed to the districts is the equalization fund. From this, each district is reimbursed for all current expenditures above an amount equal to a five mill tax on real valuation, which must be raised locally, and below a maximum set by the formula. Expenditures for transportation are not differentiated from other current expenditures. If a district so manages its program that its total expenditure, including half the expenditure for transportation falls within the upper limit of the equalization formula, then that portion of transportation costs which are not returned through the transportation quota will be returned through the equalization quota. Where this is done, it is at the expense and to the detriment of the class room program.

I. THE PROBLEM

Statement of the Problem. It is the purpose of this study (1) to examine the costs of and expenditures for transportation in selected rural central school districts; (2) to establish a formula or a method, based on all the factors which are found to apply, for determining a reasonable cost of transportation for each district; and (3) to suggest a method for distributing state aid for transportation founded on the equalization principle.

II. DEFINITION OF TERMS USED

Transportation. Transportation is interpreted as meaning the conveying, in a vehicle owned or hired by the district for that purpose, of pupils from their homes or from gathering points near their homes to school for the regular school session and their return at the end of the session.

Cost of transportation. The cost of transportation is interpreted as meaning the monetary value of services rendered or materials used during the accounting period whether such services and materials are paid for during that period or not. 1/

1/J.E.Butterworth and V. Ruegsegger, Administering Pupil Transportation. p. 106.

Expenditures for transportation. Expenditures for transportation is interpreted to mean all monies expended for transportation materials or services during the accounting period whether such materials or services are used during that period or not. 1/

Cost Classification. Transportation costs have usually been divided into two categories or classifications, fixed costs and operating costs, with subdivisions as follows:

Fixed costs:

- Depreciation
- Interest
- Insurance
- Rent

Operating costs:

- Drivers' salaries
- Gas
- Oil
- Repairs
- Maintenance

Drivers' salaries, however, have more the characteristics of such costs as insurance and rent since they are the subject of contract, are determinable in exact amount at

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1/Ibid.

the beginning of the fiscal year, and usually do not vary with the use of the transportation equipment (mileage). All of the cost items listed vary from time to time and from place to place, but not all under the influence of the same causal factors or forces. It has been found very helpful in the development of this study to reclassify the cost items in terms of the factors under whose influence they vary, as follows:

Capital costs. Capital costs are interpreted to mean those costs which under normal conditions are irrevocably fixed at the time when transportation equipment is purchased, varying only under the influence of purchase price and the terms of purchase. They are depreciation and the amortized interest on the unpaid balance of the purchase price.

Contract costs. Contract costs are interpreted to mean those costs which, while they vary from year to year, are the subject of contract and are normally known in exact amount at the beginning of the fiscal year. They vary under the influence of place location or economic area. They are insurance, rent and drivers' wages.

Variable costs. Variable costs are interpreted to mean those costs that vary with the extent to which equipment

is used and which are not determinable in advance. They are gas, oil, repairs and maintenance.

Raw costs. Raw costs will be interpreted to mean the summation of all items of the cost of transportation as defined on page 7 without regard to the quality of transportation service maintained.

Real cost. Real cost will be interpreted to mean the cost of transportation in terms of the quality of the service purchased at that cost.

CHAPTER II

REVIEW AND ANALYSIS OF PREVIOUS STUDIES ON TRANSPORTATION. A CRITICAL ANALYSIS OF FACTORS UNDERLYING COST, AND THE SUGGESTION OF A METHOD OF DEVELOPING A COST FORMULA

A preliminary step to the examination of transportation costs in New York State and the factors which may affect those costs is the examination of existing studies in this field. Not all studies in transportation are pertinent to our purpose. The following list is not broadly inclusive. It is, in fact, limited to those which have for their purposes the establishment of a formula for the determination of reasonable costs or the analysis of factors which may affect costs.

Burns' study. 1/ Burns made no attempt to analyze costs or the factors affecting costs. Predicating his study on desirability of equalizing the burden of transportation costs in New Jersey counties, he sought an index of county need in the relationship between percentage of pupils transported, density of school population, and costs. From these relationships he

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1/R.L.Burns. Measurement of the Need for Transporting Pupils. Bureau of Publications, Teachers College, Columbia University. 1927.

developed the formula

$$\frac{\text{Pupils transported}}{\text{A D A}} \sqrt{\frac{\text{area of county}}{\text{number of school buildings}}}$$

as a measure of need and recommended a plan for state participation.

Johns' study. 1/ Johns criticised Burns' study as follows:

> "The chief deficiencies of the method proposed by Burns for the state's participation in its transportation program are as follows:
>
> 1. An undiscovered relationship between cost variations and area per school building is used as a weighting factor in measuring transportation need which is out of proportion to actual cost variations independent of the control of the local community.
>
> 2. It does not provide the state with adequate administrative controls over money distributed as aid for transportation." 2/

In a study of costs in New Jersey, Pennsylvania, Connecticut, Alabama, and Florida, Johns found the best measure of need to be in the relationship between per cent of average daily attendance transported and density of population. He extended his study to include a discussion of factors that affect transportation costs: ownership of bus, make of bus, seating capacity of bus, bus depreciation, cost of bus, utilization, number of pupils transported, method of transportation,

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1/Roe Lyell Johns. State and Local Administration of School Transportation. Bureau of Publications, Teachers College, Columbia University. 1928.

2/Ibid., p. 11.

distance transported, salary of drivers, personnel of drivers, and type of road. He also included a short discussion of accounting methods and of the liability of school boards for accidents to children.

Evans' study. 1/ Frank O. Evans, in a study of transportation costs in California, made a distinctly different and more detailed approach to the problem. He reduced the unit of study from the county to the bus and route and sought the influences under which costs in this more refined unit varied. He lists as probable causes of variation:

1. Length of routes and distances children are transported.
2. Number of children for whom transportation is furnished.
3. Type of equipment used.
4. Ownership of equipment or letting contracts for transporting children.
5. Age of children -- elementary versus high school.
6. Density of school population.
7. Size of school district.
8. Topography of the country and type of roads in use.

1/Frank O. Evans. Factors Affecting the Cost of School Transportation in California. United States Department of the Interior, Office of Education. Bulletin, 1930, No. 29.

9. Type of persons used as drivers and wages paid.

10. Methods used in purchasing and in providing for services.

11. System of accounting in use.

12. Policy used in determining those entitled to transportation.

By questionnaire, he obtained from 259 high schools and elementary schools data on 610 motor busses and 44 touring cars. There were 14 cases in which railroads were used for school transportation. He found bus capacity and length of route to be most significant influences under which costs varied.

> "Many factors enter into the determination of the total cost, such as the length of the route, the number of pupils to be conveyed, the nature of the roads to be traversed, the type of equipment used, and the general level of prices and wages. Since all of these factors and others act concurrently, the task of singling out the effect of each becomes almost impossible. It seems rather that a method must be found to measure the variation in costs due to the more important factors and to modify the results to allow for the effect of other factors. Since the length of the daily trip and size of the conveyance are unquestionably the chief determinants of cost, they should be taken as the primary basis of any plan of measurement or standardization." 1/

Using the two variants, then, capacity of bus and length of route, he prepared a table of probable daily

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1/Ibid., p. 18.

costs: 1/

TABLE III

ESTIMATES OF COST PER DAY
BASED ON MILEAGE AND SEATING CAPACITY
FROM REPORTS ON 349 HIGH-SCHOOL BUSSES

Daily Mileage	Seating capacity							
	15	20	25	30	35	40	45	50
15	$3.33	$4.15	$5.00	$5.85	$6.70	$7.55	$8.40	$9.25
20	3.75	4.60	5.45	6.30	7.15	8.00	8.85	9.70
25	4.20	5.05	5.90	6.75	7.60	8.45	9.30	10.15
30	4.65	5.50	6.35	7.20	8.05	8.90	9.75	10.60
35	5.10	5.95	6.80	7.65	8.50	9.35	10.20	11.05
40	5.55	6.40	7.25	8.10	8.95	9.80	10.65	11.50
45	6.00	6.85	7.70	8.55	9.40	10.25	11.10	11.95
50	6.45	7.30	8.15	9.00	9.85	10.70	11.55	12.40
55	6.90	7.75	8.60	9.45	10.30	11.15	12.00	12.85
60	7.35	8.20	9.05	9.90	10.75	11.60	12.45	13.30

Noble's study. 2/ Noble examined cost data and factors affecting costs on county owned and operated school busses in 50 North Carolina counties. The unit of study was the bus; the factors to which he gave attention, as being significant to costs were: the size of load, the age of the bus, the type of road, carrying capacity of bus, the make of bus, and method of operation (the contract method as against the county-owned

1/Ibid., p. 20.

2/M.C.S. Noble, jr. Public School Bus Transportation in North Carolina. Publication No. 172, issued by the State Superintendent of Public Instruction, Raleigh, North Carolina.

and county-operated method of transportation). His findings with respect to the factors named were as follows:

Size of load. Daily per capita cost and costs per mile decreased as size of load increased; daily cost per truck increased as load increased.

Type of road. There was a definite relationship between costs and type of road, better roads reducing daily cost per bus 33.40%, daily per capita costs 25.34%, and cost per truck 18.71%.

Carrying capacity of bus. Increased capacity in tons resulted in decreased daily per capita costs, but had no relationship to cost per mile nor to daily cost per bus.

Make of bus. There was a variation in costs due to make from a low daily per capita cost of $.04859 to $.06725.

Method of operation. Contract service was approximately 31% more expensive than county owned and operated service. The latter meant lower daily cost per bus, lower cost per bus mile and lower per capita cost.

Noble than equalized the variability of the six named factors by the use of calculated multiples to give

them equal emphasis and prepared a method of determining reasonable daily per capita cost in terms of the seven variants.

Roberts' study. 1/ Roberts made a study of 261 Arkansas school districts receiving state aid for pupil transportation in 1930-31. He selected as factors possibly affecting costs:

Factors relating to pupils:

Pupils transported per year

Pupils transported per bus load

Pupils transported per bus per day

Factors relating to bus routes:

Type of road

Length of route

Number of round trips per day

Bus mileage per year

Factors relating to busses:

Days operated per year

Seating capacity

Ownership of bus

Make of bus

Cost of bus (new)

Age of bus

1/Roy W.Roberts. An Analysis of the Cost of Pupil Transportation in Arkansas. University of Arkansas, College of Agriculture. Bulletin No. 316.

Factors related to bus drivers:

Age

Vocation

Factors relating to school districts:

Topography of school district

Purchasing policies of school board

By statistical analysis, he found that the two managerial factors, cost of bus and type of bus driver, and two non-managerial factors, the length of route and the number of pupils transported per bus per day, were highly significant. Believing that a cost formula should be based on only those factors which are independent of district control, he first calculated a formula ignoring the effect of managerial factors and prepared a table of estimated costs, similar to that prepared by Evans, but in which the variables were route mileage one way and pupils per bus per day. Of his choice of factors and the reliability of his table, he said:

> "Summarizing the characteristics of the plan, one may say that it conforms to established principles, in that it is based on factors beyond the control of the school authorities, represents average expenditures for transportation under similar circumstances, need not be computed separately from other functions of the school, and is flexible to the extent of recognizing two influential factors affecting the cost of pupil transportation in Arkansas. The plan, however, has some

> disadvantages. In the first place, there is no evidence to indicate that the average program is the most satisfactory or even the most economical program. In fact, the large number of contract buses having locally constructed bus bodies would seem to indicate that a state would perhaps do well to base aid on standard rather than average practices. Then, too, the low relationship between route mileage and pupils transported, and the cost of transportation causes one to question the reliability of any estimate of cost arrived at entirely by means of factors beyond the control of local boards of education. These facts, together with the high relationship between cost of transportation and the managerial factors, such as cost of bus, salary of bus driver, and transportation policies, strengthened by the apparent tendency for the maximum allowance to become the cost of contract transportation, suggest that at least some consideration be given to alternative plans based in part on the managerial factors." 1/

Then, because of the revealed uncertain relationship between non-managerial factors and total costs, Roberts offered a second formula in which route mileage and pupils transported were the basis for predicting current expense and the managerial factor, cost of bus, was introduced as the basis for estimating capital outlay.

Amis' study.2/ Amis made a study of 60 central rural school districts of the state of New York, obtaining his information by questionnaire from the districts. He selected for examination a more extensive

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1/Ibid., pp. 22-25.

2/Otis C. Amis. An Analysis of Certain Factors Affecting the Cost of Transportation in the Central Rural School Districts of New York State. Doctoral study. Cornell University. 1939.

battery of possible factors than any of the previously mentioned writers, as follows:

Factors relating to busses and routes:

Seating capacity of bus
Pupils hauled per bus per day
Average number hauled per trip
Annual distance traveled per vehicle
Length of routes one way
Original cost of vehicle (depreciation)
Annual cost of current operation
Time vehicle stops per day or per trip
Make of vehicle
Ownership of vehicle
Number of days operated per year

Factors relating to management:

Wages of drivers
Age of drivers employed
Drivers employed on full or part-time basis
Wholesale or retail purchase of supplies and equipment
Servicing and maintenance plan
Location of storage garages
Busses housed in heated or unheated garage

Factors relating to the school district:

Area of district

Density of pupil population

Number of years district has provided school transportation

Annual school budget for the district

Distance of the school from a large center of population

Factors relating to highways:

Topography -- mountain or level road

Mean annual snowfall

Road surface

Amis based his plan for predicting costs on total cost (rather than on cost items) because, "first, the interest of the central rural principals and of the officials of the State Department of Education, from the standpoint of cost, is in total cost; second, the variation of the various elements going into cost are so great as to make further analysis and prediction of doubtful value." 1/ Because of their significant influence in determining costs and because they are factors little affected by local community control, he chose, as the factors upon which prediction was to

1/Ibid., p. 180.

be based, miles traveled per bus per day, and the total number of pupils transported per bus per day. By regression, he developed the equation

$$X_1 = .017X_2 - .026X_3 - 7.13$$

when X_1 equalled cost per day in dollars, X_2 equalled miles per bus per day and X_3 equalled the number of pupils hauled per bus per day. On the basis of that regression equation, he offered formulas for state participation in transportation costs.

Hutchins' study. 1/ Hutchins made an extensive study of school transportation in Ohio. He selected 70 factors as possibly or probably affecting transportation costs and by the correlation method determined their relation to total district costs. Of the seventy he finally determined on 10 as being of particular significance:

Number of pupils transported

Number of vehicles used

Present value of school-bus equipment

Total number of trips

Percentage of forward facing seats

Number of busses owned by board

1/Clayton D. Hutchins. The Distribution of State Funds for Pupil Transportation. Doctoral study, Ohio State University. 1938.

Condition of roads

Area of school district

Total miles busses are driven daily

Number of months busses will operate

By weighting and scoring each of the above factors and attaching to each score a monetary value (plus or minus), he developed a formula for predicting reasonable cost per pupil per month. Significantly different from the other studies reported, are the introduction into the formula of a large number of factors, the inclusion of managerial factors, and the enlargement of the cost unit to the district.

West Virginia Study. 1/ The State Board of School Finance of West Virginia is making a comprehensive inquiry into school bus operation in West Virginia for the purpose of preparing a formula for reasonable costs. This study, outlined in a series of preliminary reports dated from May to December 1940, has, for the unit for study and prediction, the bus and route. "The cost of school transportation in an administrative area is the sum of the individual costs for all routes operated by the administration, plus supervision

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1/West Virginia Transportation Series, Preliminary Report. Memoranda 1-6. 1940.

costs for the area." 1/ The factors affecting cost are listed as:

1. Maximum number of pupils riding at one time
2. Number of stops
3. Days operated per year (length of school term)
4. Length of route
5. Hills
   - Mileage on grade 3.5 --7%
   - Mileage on grade over 7%
6. Type of road
   - Mileage on hard surface road
   - Mileage on gravel road
   - Mileage on dirt road
7. Age of bus

The distinctive feature of this study is in the fact that it seeks to establish reasonable items of cost. In terms of the factors listed, norms will be determined for items classified as follows:

1. Annual capital cost
2. Insurance
3. Garage or shelter
4. Drivers' salaries
5. Fuel consumption
   - For normal use
   - For starting
   - For climbing
6. Oil consumption
7. Tire consumption
8. Maintenance cost

1/Memorandum No. 3. p. 1.

The formula for estimating a standard program for a county unit is in two parts:

1. Bus costs -- the summation of the cost items of all of the individual routes.

2. Non-bus costs
   Non-bus transportation
   In-lieu costs
   Administration

The report contains the following commentary on the method of approach:

> "In the past, cost of transportation has usually been treated as a lump sum. It was difficult to isolate the items which were consuming too much or too little of the transportation funds. The new formula for determining the standard costs of transportation makes possible a careful study of the cost item by item and presents a method for comparing actual expenditures with estimates of proper costs. This should prove a real help to administrators." 1/

Review of significant features of foregoing studies. It is extremely helpful at this point to make a comparstive review of the studies reported and to offer a critical analysis of some of their more salient features. The accompanying table points out some of their similarities and differences.

1/Memorandum No. 6, p. 10.

TABLE IV

COMPARATIVE REVIEW OF SOME CHARACTERISTICS OF 7 STUDIES ON COSTS OF SCHOOL BUS TRANSPORTATION

Author of Study	Unit for Study & Prediction	Costs Studied	Factors Admitted into Formula
Burns	County	Total costs	Non-managerial Percentage of children transported Density of school population
Roberts	Route	Total costs	First Formula: Non-managerial Route mileage Pupils transported per bus per day Second Formula: Managerial Cost of bus Non-managerial Route mileage Pupils transported per bus per day
Johns	County	Total costs	Non-managerial Per cent of A D A transported Density of population
Evans#	Route	Total costs	Non-managerial Length of daily trip Capacity of conveyance
Amis	Route	Total costs	Non-managerial Miles per bus per day Pupils per bus per day

#Evans, Roberts and Amis, all of whom wrote formulas based on non-managerial factors, called attention to the important part in costs played by the managerial factors and the inadequacy of any measure that ignored them.

TABLE IV (cont.)

Author of Study	Unit for Study & Prediction	Costs Studied	Factors Admitted into Formula
Noble	Route	Total costs	Managerial Age of bus Make of bus Method of operation Capacity of bus Non-managerial Type of road Size of load
Hutchins	District	Total costs	Managerial Value of equipment Percentage forward facing seats Ownership of busses Number of vehicles used Number of trips Total miles driven Months busses operate Non-managerial Number of pupils transported Condition of roads Area of school district
West Virginia Study	Route	Part costs Capital costs Insurance Shelter Salaries Fuel Oil Tires Maintenance	Managerial Cost of bus Days operated Number of stops Age of bus Non-managerial Number of pupils Length of route Hills Type of road

Unit for study and prediction. Two of the writers whose studies have been reviewed here took as the unit for study and prediction the county, one the district, and five the bus route. Which is most useful? Three criteria enter into the selection: the ease with which a formula can be determined; the ease with which it could be administered after formulation; and the reliability of the formula derived. The county, as the unit of study for New York State must automatically be dropped since the county as such is not an integral part of the educational organization of the state. The choice lies between the district and the bus route. Transportation costs for the districts in New York State are readily available either from the State Department of Education or from the districts themselves. Most of the items of cost for the ownership and operation of each separate bus are either on record or may be determined from existing records. There may be some but no material advantage of ease in preparing and administering a formula on the district unit.

From the point of view of reliability, however, the overwhelming advantage is with the smaller division. Consider comparable units in both categories.

Two routes, each involving the transportation of 40 pupils, will require the same size conveyance, the same housing space, the same insurance charges, and the same wage charge; the only variation will be in operation expenses due to length of route, number of stops, type of road, etc. 1/ Two districts, however, may involve the transportation of the same number of children but the characteristics of the units may cause wide variation in all cost items. One district, for example, may transport 200 pupils with four fifty-passenger busses. Another district, because of topography and the distribution of population, may require five or six busses of smaller capacity with a material increase in all the items of cost: cost of equipment, housing, insurance, wages, maintenance, and operating costs. In the smaller unit there are fewer items of cost in which variation due to the characteristics of the unit takes place, and the limits within which costs fluctuate are appreciably narrowed. The smaller the unit, the greater is the possibility

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1/It is immediately obvious that variation does occur in rent charges, insurance, driver's wage, and even in the cost of conveyance. These variations, however, are caused by external factors, such as economic conditions or managerial practice, and are not due to the characteristics of the route. They do not invalidate the argument here presented.

of achieving reliability in the expression of a cost formula and the greater the accuracy possible in its administration.

The pupil transported as a measure of transportation need. With one exception, all of the reviewed studies admitted pupils transported, more or less diluted, as a determining factor in the ascertainment of reasonable costs. Burns and Johns used pupils transported in conjunction with density of population; Roberts and Amis used pupils transported and route mileage; Noble used size of load as one of six determining factors; Hutchins made it one of the ten factors on which he based costs. Roberts says: "The number of pupils transported has a significant effect on the cost of pupil transportation and the most satisfactory basis for measuring this effect is the number of pupils transported per bus per day." 1/ On the other hand, Evans says: "The average cost per bus mile or per pupil is of little value in setting up standards by which efficiency of transportation projects can be determined. The variation from these averages is too great and depends largely upon other factors

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1/Roy W. Roberts. An Analysis of the Cost of Pupil Transportation in Arkansas. p. 25.

than efficiency." 1/ The present writer leans to the latter position. The number of children to be transported is a determinant in the total seating capacity necessary for transportation purposes but in so varying a manner and with such resulting variation in costs that an attempt to measure the latter by the former leads to frequent and in many cases wide error. Density of population has been used in some studies in an endeavor to control this variation. But density of population is relatively a meaningless term without its corollary distribution. Evans writes:

> "Recent studies have been made showing that the need for school transportation can be estimated from the density of school population. This method has been applied to two counties in California with quite different results. In the first county the distribution of population is fairly uniform and the estimates checked closely with the actual transportation furnished. In the second county, which is larger and contains much unimproved land, the method was found to have little application." 2/

The number of pupils to be transported determines total seating capacity needed; their distribution determines the number and size of the units to be employed. An effect of distribution is shown in Table V, which shows

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1/Frank O. Evans. Factors Affecting the Cost of School Transportation in California. p. 21.

2/Ibid., p. 33.

the average unit seating capacity of the bus fleets of 68 New York State central rural districts in the school year 1939-40.

TABLE V

AVERAGE UNIT SEATING CAPACITY
IN 68 NEW YORK STATE CENTRAL DISTRICTS, 1939-40

Class Limits (Capacity)	Number of Districts	Number of Busses	Average Unit Capacity
20--29.9	2	16	26.4
30--34.9	10	73	33.0
35--39.9	26	170	37.7
40--44.9	14	95	42.5
45--49.9	12	76	47.6
50--60.0	4	23	53.7
	Low	23.8	
	High	58.0	
	Mean	38.0	

The above table was prepared by finding the mean unit seating capacity of each bus fleet and average these means without weighting for the number of busses. No attempt was made to determine whether routes were laid out in such manner as to insure the most effective and economical service. Bus routes in New York State are approved by the State Department of Education and that they are laid out in a way to achieve reasonable standards of effectiveness and economy can be assumed. What this table indicates, then, is that topography and distribution of population,

factors beyond the control of the district, have placed on the districts transportation problems that vary widely in their characteristics and will vary just as widely in necessary costs and in such manner that to find reasonable costs in terms of pupils is impossible.

Another element which combines with population distribution to destroy the value of the pupil as a measure of transportation need, is the factor of utilization. Bus utilization may be partly due to distribution: that is, where routes are short busses may make two or even three trips; where routes are long, they can make but one. But utilization is also a result of management. Many rural schools operate with a stagger system, the high school session beginning at 8 o'clock in the morning, the grade school session at 9. In the afternoon the grammar school closes its program at 3, the high school at 4 p.m. This makes it possible to get increased service from the transportation equipment and appreciably lowers the cost in terms of the pupil transported. Table VI shows the percentage of seating capacity utilized in 68 central rural districts, any appreciable excess over 100% usually indicating that one or more busses make more than one trip morning and night.

TABLE VI

PLACE UTILIZATION IN 68 CENTRAL DISTRICTS IN NEW YORK STATE, 1939-40

Class Limits (Percentage)	Number of Districts	Number of Busses	Percentage of Seats Utilized
-99	13	94	89
100-149	43	285	120
150-199	6	49	174
200-249	3	10	213
250-299	3	15	281
	Low		74%
	High		286%
	Mean		130%

It can readily be seen from the above that several districts do not get 100% use of their equipment even once a day, one school, in fact, getting only 74% use of its seating capacity. Other schools use their equipment regularly to run three trips morning and night, the place utilization in one district being 281%. Basing costs on the pupil transported for such widely varying situations is patently impossible.

Factors to be admitted into a cost formula. Five of the reviewed studies on transportation, in expressing a formula for determining reasonable costs, used only non-managerial factors, three admitting managerial factors into its calculation. Johns writes: "The weighting factor for costs should be based on some

independent variable beyond the control of the community." 1/ But Roberts, who was among those to admit only those factors beyond community control, found the relationship between his chosen non-managerial factors and cost to be very low, while the relationship between the managerial factors, cost of bus and drivers' wage, was high (see page 17). He writes: "It is doubtless evident that such factors of business management as cost (new) of the bus and occupation of the driver contribute more to making up the total cost of transportation than does the number of pupils transported or the route mileage." 2/ Evans said: "A much closer prediction of cost can be made by use of the bus as the known variable than from the use of both mileage and load together." 3/

Two reasons suggest themselves for including managerial factors into the calculation of a cost formula.

1. The first of these is the preponderant part of

1/Roe Lyell Johns. State and Local Administration of School Transportation. p. 12.

2/Roy W. Roberts. An Analysis of the Cost of Pupil Transportation in Arkansas. p. 21.

3/Frank O. Evans. Factors Affecting the Cost of School Transportation in California. p. 23.

total costs chargeable to those cost items which are ordinarily considered as varying largely through variations in managerial practice. These include: cost of bus (depreciation), interest charges, rent, insurance and drivers' wages. How large a part they play in total costs is suggested by the following figures taken from the cost analysis of Chapter IV. In the seventy-four central rural districts studied, the average bus was of 41 pupil capacity, its cost was $5,892.10, and its annual mileage was 8,045 miles. The cost of operating this bus, determined by computation and average, is as follows:

Depreciation (10% of purchase price)...	$389.21
Interest on unpaid balance (computed)..	48.85
Rent (average per bus of all sizes)....	107.24
Insurance (Minimum rate - Property Damage, Bodily Injury, and Drivers' Compensation)	85.48
Wages (Average of all districts).....	575.00
Operating costs (Average seat-mile cost, .001149 X 41 X 8045)	378.99
Total annual cost ..	$1584.77

The first five items of cost (those considered most responsive to managerial practice) comprise 76% of the total; And even operating costs vary because of managerial policy in the purchase of supplies and in the manner of having repairs made.

2. The second reason for the inclusion of managerial factors in cost computation is the part played

by management in the improvement of transportation service. They have been generally excluded on the ground that management is responsible for extravagance and inefficiency where they exist. It must be remembered that management is also originally responsible for most of the improved standards of equipment, of driver personnel and of general quality of transportation. Improvements originate in a single or in scattered districts; are copied; then become general. The average practice of today becomes the minimum practice of tomorrow. Any cost formula that ignores the management factor tends to freeze transportation practices at their present level.

Total costs vs cost items. Seven writers reviewed in the earlier part of this chapter selected certain of the factors underlying the costs of transportation and related or attempted to relate them to the total cost of transportation in the educational unit involved, the West Virginia Study alone being directed toward an estimation of part costs. Amis wrote: "The reasons for using a total cost prediction are twofold: first, the interest of the rural central principals and of the officials of the State Department of Education, from the standpoint of cost, is total cost; second,

the variations of the various elements going into cost are so great as to make further analysis and prediction of doubtful value." 1/ Evans complained that, while many factors enter into the determination of total cost, the task of singling out the effect of each is almost impossible (see page 13). It seems to this writer that Amis' difficulty with the variation in the elements of cost and that of Evans in measuring the effect of underlying factors on total costs are related. It can be illustrated by any of the several Adirondack districts of New York State where the tendency is toward long routes over hilly and frequently poor grade roads, which tend to increase variable costs. At the same time, the Adirondack section is in general a low cost area with low wage and housing costs. To show the net effect of these conflicting tendencies on total costs does pose a problem difficult of solution. The fact is that underlying cost factors do not attach to total costs directly but through the cost items, and the solution lies in the division of total cost into its elements and the attachment of each factor to the

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1/Otis C. Amis. An Analysis of Certain Factors Affecting the Cost of Transportation in the Central Rural School Districts of New York State. p. 180.

cost item or items it directly affects. The classification of costs used by the New York State Department of Education is adequate:

Fixed costs:

Capital costs (cost of equipment)

Interest

Insurance

Rent

Operating costs:

Wages of drivers

Gas

Oil

Tires, chains and accessories

Repairs

Maintenance

The factors underlying costs have been variously listed. The following is a fairly comprehensive list of the factors dealt with by other writers on this subject, only those being omitted that seemed a restatement of some already on the list or which were cost items rather than factors. Economic conditions and quality of transportation service have been added.

Pupil Factors:

Number of pupils transported
Pupil-miles
Pupils per vehicle
Density of pupil population
Size of pupil

Vehicle factors:

Capacity of vehicle
Ownership of vehicle
Make of vehicle
Age of vehicle
Per cent of forward facing seats

Distance and road factors:

Length of route
Number of days operated
Type of road
Topography
Number of stops
Amount of snowfall
Total bus miles

Other factors:

Age of drivers
Occupation of drivers
Economic conditions
Quality of service

Analysis and criticism of the factors underlying cost.

Some of the listed factors are not constant or consistent in their effect on cost. This can be said of the whole group of pupil factors. Distribution of population and bus utilization destroy the reliability of the pupil as a measure of need (see page 30). Of the pupil group, average load comes closest to measuring need but it fails to meet one situation common in New York State. Busses are frequently called upon to operate over two routes (or the same route twice) with a full load on one trip and a partial load on the other. The

size of the vehicle is determined by the full load. The cost of operating it over a second route cannot adequatelybe measured by the partial load then carried. A more reliable measure is needed.

Some of the factors named do not apply to conditions existing in New York State:

Percentage of forward-facing seats. The standards for bus purchase set up by the State Department of Education require that busses have only forward-facing seats. The law was not retroactive, but very few busses containing crosswise facing seats remain. In the 81 districts (operating 382 busses) that gave information on directional seating, only one bus was found with seats facing crosswise.

Age of driver. The age of the driver is a factor where student drivers are used and a difference in wage can be attributed to the age difference. In New York State, only adult drivers may be employed and no wage differential because of age is found.

Occupation of driver. This again is properly a factor where drivers include pupils, teachers and patrons and wage differences between the three groups are distinguishable. In New York State, however, there are no pupil drivers; and the policy has been against

the employment of teachers as drivers. In the districts studied no regular teacher drivers were found; in only one district were teachers used as emergency drivers.

Total bus miles. The New York State Department of Education interprets public school transportation to mean the conveying of pupils to school for attendance at a regular session and their return (see definition, page 7). Total annual mileage is useless as a factor determining costs at any place where transportation is so limited by definition. Much of the total mileage of any school bus fleet is made up of extra-route mileage, either the transportation of pupils on athletic trips, field trips, etc., or the transportation of patrons for school activities. Thirty-nine of the schools participating in this study reported a total of 58,261 miles, 3.3% of all mileage, driven in extra-route transportation of pupils, an average of 1,494 each. The transportation of patrons was not so common, twelve schools reporting a total of 8,295 miles driven for this purpose. Edward A. Doolan, in a study of extra-route transportation in New York State, reported a non-routine uses of school busses which is summarized as follows:

TABLE VII 1/

EXTRA-ROUTE USE OF SCHOOL BUSSES
IN 78 NEW YORK CENTRAL SCHOOL DISTRICTS, 1941

Purpose of Trip	Number of Schools Reporting	Number of Trips Reported
For transporting pupils:		
Field trips	78	1406
Athletic trips	76	1523
Overnight trips	13	18
Out of state trips	2	3
Evening trips to school	49	320
Miscellaneous trips	9	51
For transporting patrons:		
Athletic trips	11	84
Evening affairs	27	162
Farm & Home Week	7	7
Organizational	2	2
Miscellaneous trips	2	2
Summer trips for pupils:		
Recreational trips	5	130
Band or music	8	22
Agriculture	4	9
Miscellaneous trips	3	13

In writing of the desirability of extra-route bus use, Doolan says:

> "Since the factor of distance is of so much greater importance in the activities of the rural schools than in similar activities in city schools, the transportation systems of the rural schools, although provided primarily for regular route use, are instrumental, even essential, in the execution of such programs. If the view is held that the pupils in these schools are entitled to the same

1/Edward A. Doolan. A Study of Non-Routine Uses of School Busses in New York State Central Rural Schools. Master's Thesis, Cornell University. 1941.

> opportunities for self-expression through these activities requiring transportation for their satisfactory functioning, then the use of school busses for such purposes must become an accepted and necessary part of such a program." 1/

The growing concept of the community school, a school serving the needs of the adult community, as well as its pupil population, a center of community interest and activity, suggests the possible need for extended transportation service. Doolan says of the transportation of adults: "If the district can maintain a high level of educational service for its children and still provide those services which will tend to bring about community integration and welfare, then these services are equitable and desirable." 2/

Much extra-route use of school busses is admittedly contributory to essential school activities; more is desirable. Nevertheless, it seemed wiser, in an attempt to develop a transportation formula to adhere to the state definition of transportation, while admitting its inadequacy.

It is highly doubtful whether two of the factors listed on page 36 have a proper place in formula for the determination of reasonable minimum cost.

1/Ibid., p. 54.

2/Ibid., p. 61.

Ownership of bus. Noble and Roberts found that school-owned and operated bus service was more economical than contract service. School authorities generally claim for school-owned transportation an advantage in flexibility and adaptability. To grant an increment because of the increased cost of contract service would seem to subsidize an undesirable practice.

Make of bus. It is doubtful, also, if a cost differential in terms of make of bus should be recognized. If one make gives superior performance because of mechanical advantages, the differential should be made in terms of those advantages rather than in terms of a make-name.

This leaves, of the factors listed on page 40, the following:

Capacity of vehicle
Age of vehicle
Length of route
Number of days operated
Type of road
Topography
Number of stops
Amount of snowfall
Economic conditions
Quality of service

Of these, two will be excluded from further consideration as being without sufficient influence in the

determination of costs to warrant their inclusion into a cost formula.

Age of bus. Amis found that managerial practice, in New York, nullified any increase in cost that might be attributed to the age of the conveyance.

> "The bus cost per day decreased from $10.13 to $8.07 as the age of busses increased from one to 9 years. Bus-mile, pupil per day and pupil-mile costs tended to increase, as the age of the bus increased. The reason for these increased bus-mile and per-pupil costs is not attributable, however, to the increased ages of the busses since it can be seen that the per bus per day cost fell with increasing age. The explanation lies in the fact that the older busses travel fewer bus miles annually and tend generally to haul fewer pupils than newer busses. There is evidence from these data of a general managerial practice of assigning busses to shorter routes and lighter pupil loads as they increase in age." 1/

Topography. None of the reviewed writers on transportation costs found any measurable relationship between costs and topography. With regard to this factor Amis wrote:

> "In an attempt to determine the effect of highway grades upon cost, the State Highway Engineering Department was consulted and also the Department of Automotive Engineering, Cornell University. It was found to be the opinion of engineers in these departments that for automotive vehicles traveling a 'closed route,' that is a complete circuit in which the upgrade equals the downgrade, there would be no added

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1/Otis C. Amis. An Analysis of Certain Factors Affecting the Cost of Transportation in the Central Rural School Districts of New York State. p. 149

> cost due to grade, provided the grade does not exceed the automotive ability of the vehicle to perform normally and the vehicle load is not excessive." 1/

Relationship between cost factors and cost items. The remaining cost factors have all been found by other students to affect costs, and should be further analyzed to determine which of the cost items they consistently influence. It has already been pointed out that some of the difficulty experienced by other writers is due to the effort to attach factors directly to total costs. Frequently they conflict, and to find a net effect on total costs is impossible. The factors do, however, directly and consistently affect cost items. An analysis of the factors, indicating which of the cost items listed on page 39 they affect, follows:

Capacity of bus. Carrying capacity of bus shows a positive relationship to cost of bus, and through cost to interest charge, to insurance (partly dependent on capacity) and to the costs of gas, oil, tires, chains and accessories, repairs and maintenance. There was found, in this study, no relationship between size of conveyance and driver's wages, nor between

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1/Ibid., p. 115.

size of bus and housing costs.

Length of route, number of days operated, type of road, number of stops, amount of snowfall. There is a relationship between all of these route factors and the cost of gas, oil, tires, chains and accessories, repairs and maintenance, but no relationship between them and cost of vehicle, interest charges, insurance, rent or wages of drivers.

Economic conditions. Economic conditions, or the factor of varying cost levels in different areas within the state, affects drivers' wages, housing costs, insurance, and probably repairs and maintenance charges. It has no affect on cost of vehicle, interest, or the cost of gas, oil and accessories.

Quality of service. Quality of service is an over-all factor and affects all the items of cost; purchasing costs and interest through the selection of improved equipment; drivers' wages because of the employment of highly qualified personnel; gas, oil, etc. through the provision of superior service.

Classification of costs in terms of the factors by which they are affected. Examination of the cost items listed and the cost factors attached to each, shows that they readily fall into three groups

as follows:

A. Capital costs:

Depreciation -- the purchase price amortized over the expected life of the bus.

Interest -- the interest on unpaid balance of purchase price amortized in the same way.

These costs are directly affected by capacity of bus. Insurance is also partially dependent on capacity of conveyance.

B. Contract costs:

Insurance

Rent

Drivers' wages

These costs are affected by the factor of varying cost levels in different areas within the state.

C. Variable costs:

Gas

Oil

Tires, chains and accessories

Repairs

Maintenance

Variable costs are directly affected by capacity of bus, length of route, type of road, number of stops, amount of snowfall and number of days operated.

The method to be followed in the development of a formula for determining reasonable cost. The difficulty involved in the ascertainment of total cost in terms of underlying factors has been pointed out, as has the relationship between the factors and cost items. The writer has also indicated his belief that the most accurate measure of need can be made in the smallest operating unit -- the bus route. These concepts suggest the procedure to be followed in determining reasonable cost, that is, by the ascertainment of reasonable items of cost in terms of affecting factors.

1. Reasonable capital costs: depreciation and interest on unpaid balance in terms of the average price paid for busses in each of selected categories of capacity. An adjustment can be made to this item for the difference in insurance costs due to capacity.

2. Reasonable contract costs: insurance, rent and wages in terms of average costs in basic low cost areas, with adjustment for the higher cost areas made through the construction of a county index.

3. Reasonable variable costs: gas, oil, tires, chains and accessories, repairs and maintenance in terms of per-mile costs for busses in each size category and under varying conditions of road, stops and snowfall.

4. A study of the quality of transportation and its relation to cost with adjustment to the cost formula if the study indicates its desirability.

CHAPTER III

SOURCES AND LIMITATIONS OF DATA AND METHODS OF PROCEDURE

The devising of a transportation cost formula means the establishment of a norm or norms against which particular practices can be measured. Such a norm might be expressed as a total cost figure. The conflicting elements hidden within a total cost figure and the possible wide deviation from the actual monetary requirements of any given transportation problem have been indicated in the preceding chapter. What promises greater accuracy and greater elasticity is the establishment of a norm for each of the separate items of cost that make up the total cost figure. With some exceptions, described in detail later, these norms will be built on average practice. The imperfection of average practice, under ordinary circumstances, as a norm is recognized. It may not be good practice nor adequate. But in New York State, where state minimum standards are high, and where the purchase of each bus and the laying out of each route is subject to the approval of the State Department of Education, it can be presumed to be a reasonably effectual measure of adequate

service. Establishment of norms based on average practice entails a close study of transportation costs and operating conditions in a sufficient number of districts to establish the necessary averages and to analyse the existing relationships. The purposes of this chapter are to indicate the sources of all information used in the prosecution of the study, to point out inadequacies and imperfections where they exist, and to outline the uses to which the information was put.

The rapid extension of centralization, the growth of transportation as an essential part of the central school program, and the conspicuous inequalities in the burden for support of the transportation program, have made manifest to school executives and to officials of the State Department of Education the need for a thorough examination of costs and the conditions underlying costs. The latter, particularly alive to the situation, welcomed an investigation and gave much help and valuable suggestions for its prosecution. These suggestions had primarily to do with (a) the selection of districts having the requisite characteristics for inclusion into the study, (b) the incorporation into the study of route and district factors which their experience indicated to be of particular significance in

New York State, and (c) the treatment of capital costs.

Selection of central districts for study. Five criteria were set up for the designation of districts for inclusion in a cost study.

1. They must be sufficient in number for the calculation of reasonably accurate averages and must be located spatially in such fashion that they include in their number districts representative of all variations in economic condition, topography, and depth of snowfall.

2. Only those districts were selected whose transportation systems were well established.

3. Districts were chosen with a view to getting a wide variation in size. Size in this instance was measured in terms of fleet size, it being felt that any variation in costs, not due to route factors, would be due to the more effective management possible with larger fleets.

4. Because it was decided not to admit into the formula a differential due to bus ownership, only those districts which owned and operated their own fleets were chosen.

5. Districts, to be chosen, must have filed with

the State Department of Education a full report of their costs and expenditures for the year 1939-40.

Sources of data relating to busses and cost. Officials of the State Department of Education, interested in transportation, generously placed their records at the writer's disposal. From their permanent files, 80 districts with district owned and operated busses and meeting all of the requirements of the first four criteria were chosen. Of these, six were later found to have filed incomplete cost records for the school year 1939-40 and were dropped from the list. The remaining 74, operating 495 busses, were deemed sufficient for all purposes. Figure 1 shows the location of these 74 districts on which full cost data were available. From the permanent files of the Department of Education the following informational items were obtained:

Bus number 1/
Make of chassis
Make of body
Year of purchase
Capacity
Purchase price
Driver's wage (the 1939-40 contract wage of each individual driver)

Actual expenditures for operation in each of the 74 districts for the 1939-40 fiscal year was determined

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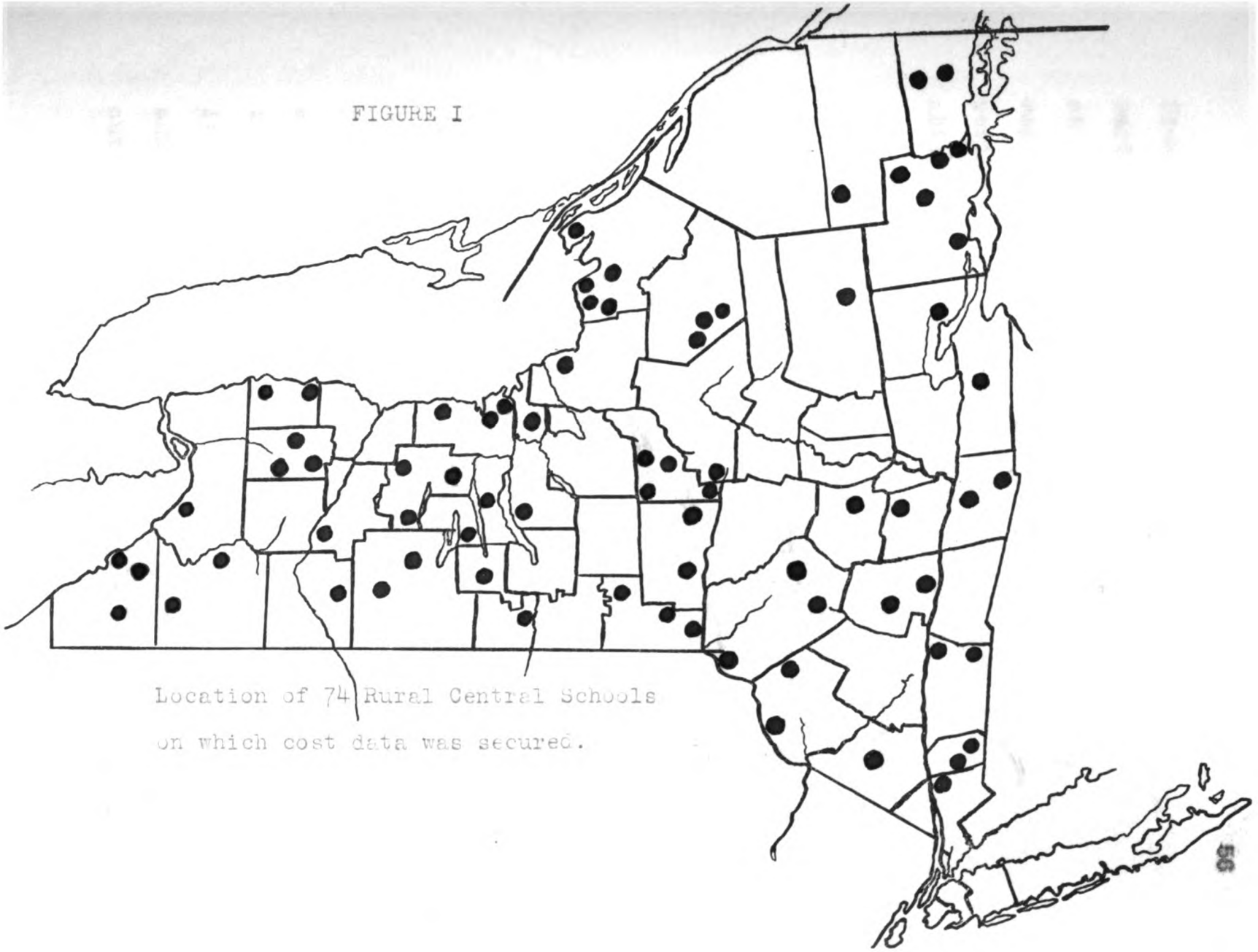
1/Bus number was of great help for identification purposes when the investigation was transferred to the disticts.

FIGURE I



Location of 74 Rural Central Schools
on which cost data was secured.

from the itemized report which accompanies and is a part of the Application for Transportation Quota, filed at the close of the fiscal year with the State Department of Education. From this report the following items pertaining to district owned transportation, were available:

Liability and property damage insurance paid by the district
Amount paid for gas and oil
Cost of repairs on district owned vehicles
Cost of maintenance of district owned vehicles
Cost of tires, chains and other accessories
Rent paid for district owned bus storage
Cost of maintenance of district owned garage
Interest payments on notes for district owned vehicles
Emergency transportation costs
Yearly mileage for each bus
Gallons of gas used by each bus
Quarts of oil used by each bus
Average cost of gas per gallon
Average cost of oil per quart

Limitations of cost data. Some difficulty was encountered, in the use of cost data, either because of the method of accounting or because of the manner of reporting costs. One characteristic of the accounting system of schools in New York State, which was found to be an impediment in the analysis of bus costs, is that it deals exclusively with expenditures and, where costs and expenditures differ, the former had to be sought out by computation, sometimes on an arbitrary basis.

Depreciation. Depreciation is not dealt with at all as a cost item in school reports. The cost of each bus is recorded and the payment on purchase price are annually recorded as an expenditure. Payments and depreciation do not coincide. The schools of New York State are not encouraged to carry cash balances nor to establish funds. Most capital purchases, therefore, are made with borrowed money. It has been the policy of the State Department to advise, and the districts generally to make, purchases of transportation equipment on a five year payment plan. Thus all capital payments take place within the first five years of the life of the bus. Depreciation is the purchase price amortized over the full life of the bus. What the life of a school bus is, and hence what the annual rate of depreciation should be, has been variously estimated from 4 to 20 years. Most studies on transportation have suggested 8 years as a reasonable life expectancy. It was the opinion of the State Department officials consulted on this point, an opinion in which the writer concurs, that 8 years is too short a period in which to get the maximum effective use of a bus. There have been rapid improvements in bus building techniques since many of the previous studies were

made, with a corresponding increase in life expectancy. Then, too, school busses receive relatively light use. Most manufacturers give, as a reasonable use expectancy, 150,000 miles. For the busses included in this study, the average annual mileage was 8,045 miles. It would seem that busses do not wear out; they are outmoded. It seems reasonable to set a life expectancy of at least 10 years, and a depreciation rate of 10%.

Interest. Interest expenditures, like capital expenditures on transportation equipment, are usually limited to the first five years of a bus' life. The logical approach to interest cost seems, not through the expenditure item, but through the purchase price and purchasing practices, involving the computation of total interest charges from average purchase price and the allotment of an equal share to each of the estimated 10 years of bus life.

Rent. Data for the computation of rent costs were most scant. Capital expenditures for school owned housing is reported only through the general capital expenditure account. In many cases the garage is attached to and is a part of the main school building and accurate cost impossible of determination.

Garage heat and light are submerged in the general heat and light expenditures. Renting expenditures were recorded in every case where outside storage space is rented. It was from this information that a rent cost, adjusted for economic area, was computed.

Insurance. The expenditure for liability and bodily injury insurance is recorded for each district but not for each bus. This was not felt to be a handicap as the most effective approach to insurance costs seemed to be through a study of the state minimum requirements for coverage and the cost of such coverage by direct appeal to insurance manuals. Insurance costs vary under two influences, the size of the bus and the location of the district. The willing cooperation of local agents of the Massachusetts Mutual and the Farm Bureau Mutual Insurance Companies made it possible to obtain:

The minimum coverage required by the state for public conveyances.

The cost of the required coverage in each of the 45 insurance zones of the state.

The deduction possible through fleet insurance.

The cost of driver's compensation in each of the 45 zones.

With this information it was possible to construct a cost table showing the cost of insurance for average

size busses in each county and to offer a correction figure for variations in size of bus.

Operating costs. A much more serious obstacle to accurate interpretation of costs was the fact that the operating costs, tires, chains and accessories, repairs and maintenance, were reported for each bus fleet but not for each bus. Calculation of a cost formula based on the bus and route requires some method of determining a reasonable cost of these items for each bus. They vary under the primary influence of two factors, size of bus and length of route. It was decided, after some thought and after seeking advice, to allocate fleet cost to the busses on the basis of the seat-mile. Much time was wasted in this procedure. It was painfully obvious, after the work was done and further analysis was attempted, that allotment of costs by this method completely destroyed all evidence of the effect on cost of the route factors, type of road and number of stops. In a revision of procedure, all of the variable costs, gas, oil, tires, chains and accessories, repairs and maintenance, were dealt with on a district basis, all the routes combined, and a final seat-mile cost of these items determined for each district.

Questionnaire to the districts. Two of the cost items reported in the Application for Transportation Quota needed further explanation and interpretation.

Rent. The rent reported varied from $25 to $1,200. In some cases it seemed obvious that the expenditure was being made for housing less than the whole fleet, but for how much or how little could not be determined except by direct appeal to the districts.

Wages. In 39 of the districts, a constant wage rate for drivers was reported; in the other 25, however, there were wage differentials within the district. It was felt necessary to get an understanding of these differentials and the reason for their existence.

To get this supplementary cost information and to get a knowledge of certain district and route factors that influence the cost of transportation, a questionnaire was prepared and mailed to the principal of each of the 74 districts for which cost data had been gathered. Within three weeks 35 replies had been received. A short letter was then sent to those who had not been heard from and further returns were received to bring the total to 64, a return of 86%. This was felt to be sufficient for continuance of

the study. 1/ A copy of the questionnaire and the two letters written to the principals are included in the appendix of this study for examination by the reader at his desire. It will be noted that information was requested for the 1939-40 school year, the year for which cost data had been gathered.

The data sought was of three kinds:

Supplementary cost data. (1) Interpretation of the rent expenditure item, as reported in the Application for Transportation Quota was asked. (2) An explanation was sought for the differentials in drivers' wages where they existed. This information was needed in the case of fewer than half of the districts. It was not included as a part of the mimeographed form but was appended in long hand in those cases where differentials existed, with the exact amounts involved given to avoid obscurity in the meaning of the question.

District and route data. Certain factors were listed in Chapter II as probably affecting the cost of

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1/The lack of reply on the part of 11 districts destroyed the value of cost data collected only in the category of variable costs (those affected by route conditions) Data on all 74 districts were used in computing reasonable purchasing and contract costs.

transportation. Information regarding these had to be obtained direct from the districts. In addition it was felt that certain districts factors might have a relation to expenditures for transportation. Information on these factors was sought also.

District factors:

Real value of district (1939-40)

Tax rate on real value (1939-40)

Total expenditure for transportation (1939-40)

Funds received from the state for transportation (1939-40)

Route factors:

Bus capacity

Number of trips

Average daily load

Number of stops

Daily route mileage

Class A road

Class B road

Class C road

Total daily route mileage

Type of road. A classification of roads to determine operating cost has been made in a number of school cost studies and by automotive companies. The West Virginia Study (see page 23) uses three classifications: hard

surface, gravel, and dirt. The Dodge Division of Chrysler Corporation, in a handbook "Fitting the Truck to the Job," gives five classifications: 1/

Best paved surfaces: concrete, asphalt, brick, wood-block

Partly worn pavement

Best type of gravel used in trunk lines

Ordinary gravel found on secondary roads

Earth roads

Any classification has to be made with consideration to the characteristics of the territory involved. After consultation with Mr. Benjamin R. Miller, State Supervisor of Pupil Transportation, and with a thought to the type of roads found in New York State rural districts, it was decided to use three classifications as follows:

1. Class A roads: concrete and macadam roads in good repair.

2. Class B roads: broken macadam and good gravel roads.

3. Class C roads: gravel roads in bad condition and dirt roads.

Construction of a road index. None of the reviewed studies describe in detail the use made of road classification in determining costs. It seemed best, to the

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1/Charles W. Kymoch. Fitting the Truck to the Job. 1940 edition. Dodge Division of the Chrysler Corporation.

writer, to approach this problem through the construction of a road index. It has already been pointed out on page 61 that, because of the manner in which costs are reported, that it was necessary to deal with variable costs using the district unit. The total daily route mileage of the busses in each district was combined to give total district mileage over each type of road. Then to obviate any error that might creep in because of the wide variance in total mileage, the class totals were converted to percentages. Next, it was necessary to give a code value to each type of road. The 1940 Handbook of the Dodge Division of the Chrysler Corporation 1/ gives a table of rolling plus air resistance on different types of roads as indicated in Table VIII. (page 67)

In construction of a code or index, these numbers can be simplified, it being necessary only to maintain a proper relationship. Class A road, as defined in this study, corresponds to the first classification in the following table; class B road seems a fair average of the second and third; class C road an average of the fourth and fifth. At 25 MPH, the resistance relationships are 14 : 20½ : 30. For convenience in

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1/Ibid., p. 86.

coding, the terminal values were taken at 0 for class A road and 1 for class C road; .4 then represents the

TABLE VIII

REPRESENTATIVE VALUES OF ROLLING PLUS AIR RESISTANCE FOR VARIOUS TYPES OF HIGHWAY SURFACE IN POUNDS PER THOUSAND POUNDS OF GROSS VEHICLE WEIGHT ON PNEUMATIC TIRES

Type of road surface	Rolling plus air resistance in pounds per thousand pounds of gross vehicle weight		
	15 MPH	25 MPH	35 MPH
Best paved surface: concrete, asphalt, brick, wood-block, average of all	12	14	19
Partly worn pavement: That is, in fair average condition, average of all	15	18	21
Yearly average for best gravel of type used in trunk lines	20	23	28
Yearly average for ordinary gravel found in secondary roads and primary system earth roads	25	28	33
Yearly average for well maintained county system earth roads	30	32	38

value of class B road with almost exact accuracy. It was possible to construct a road index for each district by multiplying the percentage of mileage travelled on

each type of road by the code value given to each type of road and totaling the resulting index values. The calculation of an index for an actual district is given here to demonstrate the method.

Calculation of District Road Index

	Class A Road	Class B Road	Class C Road	District Index
1. Route mileage	118	210	48	
2. Percentage mileage	31	56	13	
3. Code value (type of road)	0	.4	1	
4. Index value (2 x 3)	0	22	13	35

District indexes can vary from 0, when all mileage is on class A road, to 100 where all mileage is on class C road.

Number of stops. Number of stops, as reported in the questionnaire, also needed adjustment for variations in total mileage. This was done by dividing number of stops by route mileage, giving stops per mile.

Snowfall. Snowfall has not been proved a factor in the cost of transportation. Amis, in a study of New York State central schools, said:

> "While mean annual snowfall per se is not a factor affecting cost, it is a factor affecting the number of pupils to be hauled per bus per day and the number of miles to be traveled per bus annually. As such it must be reckoned with from the administrative

point of view in setting up a school transportation program." 1/

The relationships mentioned in the foregoing statement are expressed in the following table:

TABLE IX

EFFECT OF MEAN ANNUAL SNOWFALL UPON AVERAGE PUPILS HAULED PER BUS PER DAY AND AVERAGE ANNUAL MILES TRAVELLED PER BUS 2/

Mean Annual Snowfall in Inches	Number of Busses	Average Pupils Hauled Daily	Average Annual Bus Miles
20" - 29"	4	120	9882
40" - 59"	71	66	5790
60" - 79"	88	56	6663
80" - 99"	31	45	5935
Over 100"	13	37	6382

Whether there is a true causal relationship between snowfall and average pupils hauled per bus per day and annual miles travelled per bus, or whether it is simply coincident with characteristics of topography and population density and distribution that closely parallel snowfall conditions, and which are the causal factors, would have to be studied. Nevertheless, average snowfall varies to such extremes in New York State,

1/Otis C. Amis. An Analysis of Certain Factors Affecting the Cost of Transportation in the Central Rural School Districts of New York State. p. 172.

2/Ibid., p. 172.

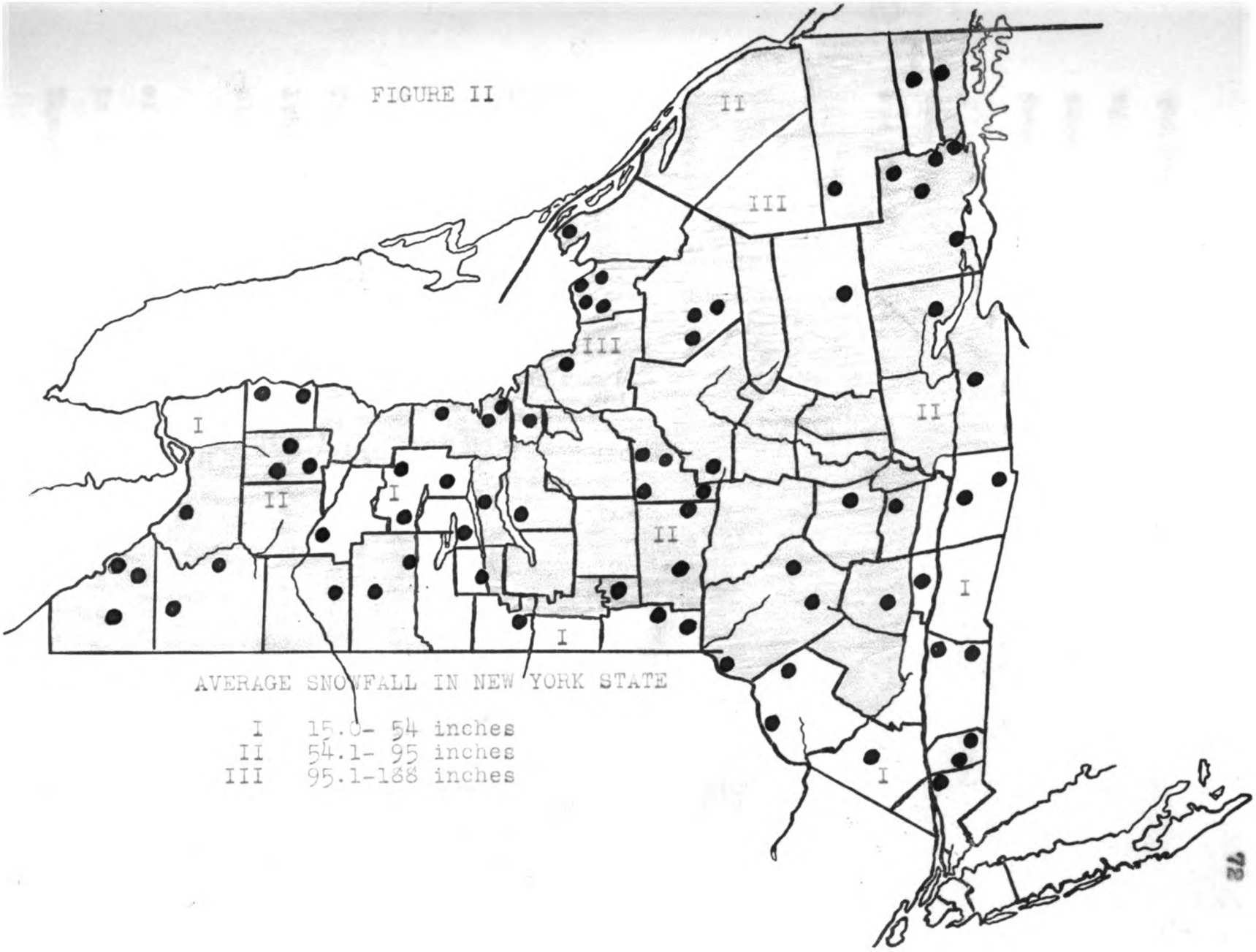
from 15 inches at one weather station on Long Island to 189 at another in the Adirondack region, that it was felt to be quite possibly a factor in affecting costs. Records of annual snowfall were kept by the United State Department of Agriculture Weather Bureau until 1930 and from 1930 to the present by the United States Department of Commerce. From the reports of these two agencies, it was possible to get the average annual snowfall in 179 weather stations in New York State, an average for periods varying from 3 to 62 years dependent of the year in which the station was established. The variation was from 15 to 188 inches, with an average of 68. These stations were located on a map of the state and, with the averages sketched in, the map was studied for possibilities of zoning. After classifying and reclassifying the stations in various ways, it was found that by combining the stations into three groups, with from 15 to 54 inches, from 54.1 to 95, and from 95.1 to 188 inches of snowfall, snowfall areas were observable. It would be helpful if, in such zoning, established political lines could be followed. It was intended at first to follow county lines. This proved impossible because in a number of counties in the Hudson, and St. Lawrence valleys, and Southern Tier,

wide variations were found within the counties themselves. The difficulty was overcome by following town lines where the county line failed to serve. Figure II shows the state zoned for snowfall, with the districts to be studied located in their respective divisions. It was expected that if snowfall did have an effect on costs it would be observable by a comparison of variable costs in the schools classified by zones.

The factor of varying costs in geographic areas -- the economic factor. There are wide variations in economic conditions within New York State, from the high cost areas adjacent to New York City to the poor farm areas of the western Adirondacks and some parts of central New York, with a probable effect on the contract cost of transportation, wages and rent. It was intended, in this study, to set up a county index reflecting varying cost levels, to find any existing relationships between this index and wages for school bus drivers and housing costs for school busses, and out of these relationships to determine reasonable costs for wages and rent. Three sources are available from which a county index might be constructed:

1. The hourly wage rate in each county for truck drivers in public works construction as established by

FIGURE II



AVERAGE SNOWFALL IN NEW YORK STATE

I	15.0- 54 inches
II	54.1- 95 inches
III	95.1-188 inches

the State Industrial Commissioner. The 1940 wage scale was obtained from the office of the Industrial Commission at Albany, the hourly rate being found to vary from $.55 to $.87½.

The Works Progress Administration has set up a schedule of monthly earnings for labor in five classes and recognizing four levels of economic condition.

TABLE X

W P A SCHEDULE OF MONTHLY EARNINGS
BY COUNTIES AND AREAS IN NEW YORK STATE
BASED ON POPULATION

	Classification of Economic Area			
Classes of Labor	I	II	III	IV
Unskilled B	52.80	49.20	44.40	40.80
Unskilled A	57.60	52.80	49.20	44.40
Intermediate	68.40	62.40	57.60	52.80
Skilled	87.60	80.40	73.20	67.20
Profession & Technical	91.20	81.60	74.40	67.20
Average - all classes	71.52	65.28	59.76	54.48

This information was received from the W P A offices at Ithaca with a list of all New York counties and their classification for cost level.

3. Insurance rates for automobiles in areas outside of cities was thought probably to have a relationship to population and through population to economic level. These rates varied from $58.59 to $77.32. (See table

XXXIII). These measures were then compared to check their consistency or the relationship between them. The following table shows the relationship between them in the 38 counties in which school transportation costs are being studied.

TABLE XI

RELATIONSHIP BETWEEN MEASURES OF COUNTY COST LEVELS IN 38 COUNTIES

Number of Counties	State Contract Wage Scale	W P A Wage Scale	Automobile Ins. Rates
20	$.55	$58.44	$63.15
5	.60	63.07	61.26
7	.65	64.73	63.17
4	.75	64.14	64.37
2	.875	63.00	71.45
Per cent increase first to last class	59%	8%	12%

The three scales show slight relationship with each other, a 59% increase from the first to last class in the state contract wage scale being paralleled with only an 8% increase in the W P A scale with erratic behavior between. The insurance scale showed 12% increase with inconsistent variations in the five classes of counties. It was felt that any attempt to combine the three would tend to narrow the range covered by any of the three alone. For this reason it was

decided to use only the state contract wage scale as county index, it being the one more closely parallel to variations in actual cost. (see Table XXIV) 1/

Quality of service. No study on transportation has considered quality of service as a factor underlying the cost of transportation. Yet it seems entirely reasonable to suppose that the quality of equipment used, the quality of driver personnel, the efficiency with which busses are serviced, the effectiveness with which the service covers its territory and the provisions made for the comfort and security of the pupils transported all would be reflected in costs. A tool for measurement of quality exists in the Ruegsegger Rating Scale, a Pupil Transportation Score Card for Measuring the Effectiveness and Quality of Service of Busses, Routes, and Transportation Systems. 2/ This scale,

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1/This measure of county cost levels is the one adopted for use in determining school bus drivers' wages in the 1942 transportation law. "Salary of a driver shall be one-tenth of the minimum hourly county wage rate, established by the industrial commissioner for truck drivers in public works construction as determined at the beginning of each school year, multiplied by the total annual (route) mileage of each school bus."

2/Virgil Ruegsegger. Pupil Transportation Score Card for Measuring Effectiveness and Quality of Service of Busses, Routes, and Transportation Systems. Educational Publishers, Inc. 1941.

prepared by the author with the aid of experts and administrators in the field of transportation, and statistically proven adequate for its purpose, is highly objective so that measurements by competent persons are comparable. The Ruegsegger scale was sent to 50 districts from which route data had been received and the principals were asked to rate, or to have an agent rate, their transportation systems. The returns from this request were understandingly very poor. The nation had just entered the war against foreign powers and principals were busy with the rationing of sugar and gasoline and with the inauguration and development of classes to train for war industry. In addition, the Ruegsegger scale is long, requiring about three hours of work for proper calculation of a score, and at the first glance seeming even more involved than it is. The writer recognized himself as asking much. Only 9 schools responded to the request by filling them out. A follow-up request brought in four more returns and a number of letters explaining the difficulties the principals were under and inviting a visit to the schools for the purpose of scoring the systems. This was done in the case of 27 schools so that a measure of quality was obtained for a total of 40

schools. Through the courtesy of the Director of the School of Education at Cornell University, Dr. Julian E. Butterworth, the score cards of eleven schools not a part of this study but scored in the same school year were used to check the validity of the measurements on 40 districts. It was found that the addition of eleven schools affected the averages very little so that the number of schools measured was believed to be adequate.

Copies of the Ruegsegger Scale and of the two letters sent to the principals are included in the appendix. The score card is divided into six major divisions with subdivisions as follows:

	Possible score	
Regularity of Service:		
Percentage of trips missed	40	
Percentage of late trips	50	
Percentage of trips by a substitute driver	25	
Percentage of trips by emergency busses	20	
Total regularity of service		135
Convenience:		
Percentage of children walking		
¼ to ½ mile		
½ to 1 mile		
Over 1 mile		

Convenience (continued)		
Percentage of above children waiting		
Without shelter		
In unheated and unsupervised shelter		
In heated but unsupervised shelter		
In supervised but unheated shelter	35	
Number of pupils waiting		
20 minutes or less		
21 to 40 minutes		
41 to 60 minutes		
More than 1 hour	30	
Time on bus	35	
Radius within which pupils are not transported	20	
Total Convenience		120
Comfort:		
Percentage of forward facing seats	25	
Percentage of seats well padded	25	
Percentage of bus bodies meeting the requirements of the State Dep't	30	
Percentage of overloading	30	
Total Comfort		110

Security:		
Percentage of pupils injured	65	
Insurance coverage carried	40	
Supervision of route	30	
Safety hazards on route	40	
First aid kit and training of driver	25	
Total Security		200
Conveyance:		
Weight capacity per rated seating capacity	25	
Percentage of rated seating capacity utilized	25	
Purchase price per rated seating capacity	25	
Present value per rated seating capacity	20	
Effectiveness of brakes	35	
Frequency of inspection	30	
Storage of busses	20	
Servicing	25	
Frequency of suspension	20	
Total Conveyance		225
Operating personnel:		
Sex of driver	20	
Age of driver	25	
Previous experience of driver	30	

Operating personnel (continued)		
Occupation of driver	20	
Tenure of driver	25	
Salary of driver	20	
Physical examination of driver	25	
Character of driver	45	
Total Operating Personnel		210
Total -- score card proper		1000
Extra merit awards		
Provision for transporting to their home children engaged in after-school activities	30	
Provision for extra route transportation for children	25	
Use of conveyance for transporting patrons	25	
Extra or unusual safety precautions	20	
Loading and unloading pupils under cover	10	
Meeting with drivers by principal or supervisor	20	
Creditable spot map	15	
Set of minimum operating regulations	15	
Any other meritorious practice or service not allowed elsewhere	15	
A satisfactory cost accounting system	25	
Total extra merit		200

In this study the extra merit score in the Ruegsegger Scale was not used because the first three items refer to uses of transportation that do not come within the state definition of transportation, and because measurement of the other seven items is subjective.

CHAPTER IV

ANALYSIS OF THE COST OF OPERATING BUSSES AND OF THE EFFECT OF FACTORS UNDERLYING COSTS; THE ESTIMATION OF REASONABLE RAW COSTS

No complete measure of the cost of transportation can be made without reference to the quality of the service provided. The initial step to a complete measure is, however, an examination of raw costs and the estimation of reasonable raw costs. Chapter II concluded with the proposition that an understanding of cost was to be arrived at only through a study of the cost items and that reasonable total cost was the summation of reasonable items of cost. It is the purpose of this chapter to examine items of cost in terms of the factors which affect them and to calculate:

1. Reasonable capital costs, depreciation and interest on unpaid balance, in terms of the price paid for busses and of the purchasing policies followed by the districts,

2. Reasonable contract costs, insurance, rent and wages, in terms of average costs in basic low cost areas, with adjustment for higher cost areas made through the application of a county index,

3. Reasonable variable costs, gas, oil, tires, chains and accessories, repairs and maintenance, in terms of a per mile cost of operating busses in each size category and under varying conditions of road, stops and snowfall.

The purchase price of busses. Capital costs include depreciation and interest, and are dependent on purchase price and purchasing and amortizing policies. The 74 New York State central districts from which data for this study were obtained owned and operated, in the 1939-40 school year, 495 busses varying in capacity from 7 to 70 pupil places, and in price from $600 to $7445. When these busses were classified according to size, it was noted that the model capacities were 31, 37, 43, 49, and 55. They were, therefore, sorted into groups of which these model sizes were as nearly as possible the group centers. The average price paid for busses in each category was then found and recorded with low and high prices paid for busses in each category and with the range in price in each. This is shown in Table XII.

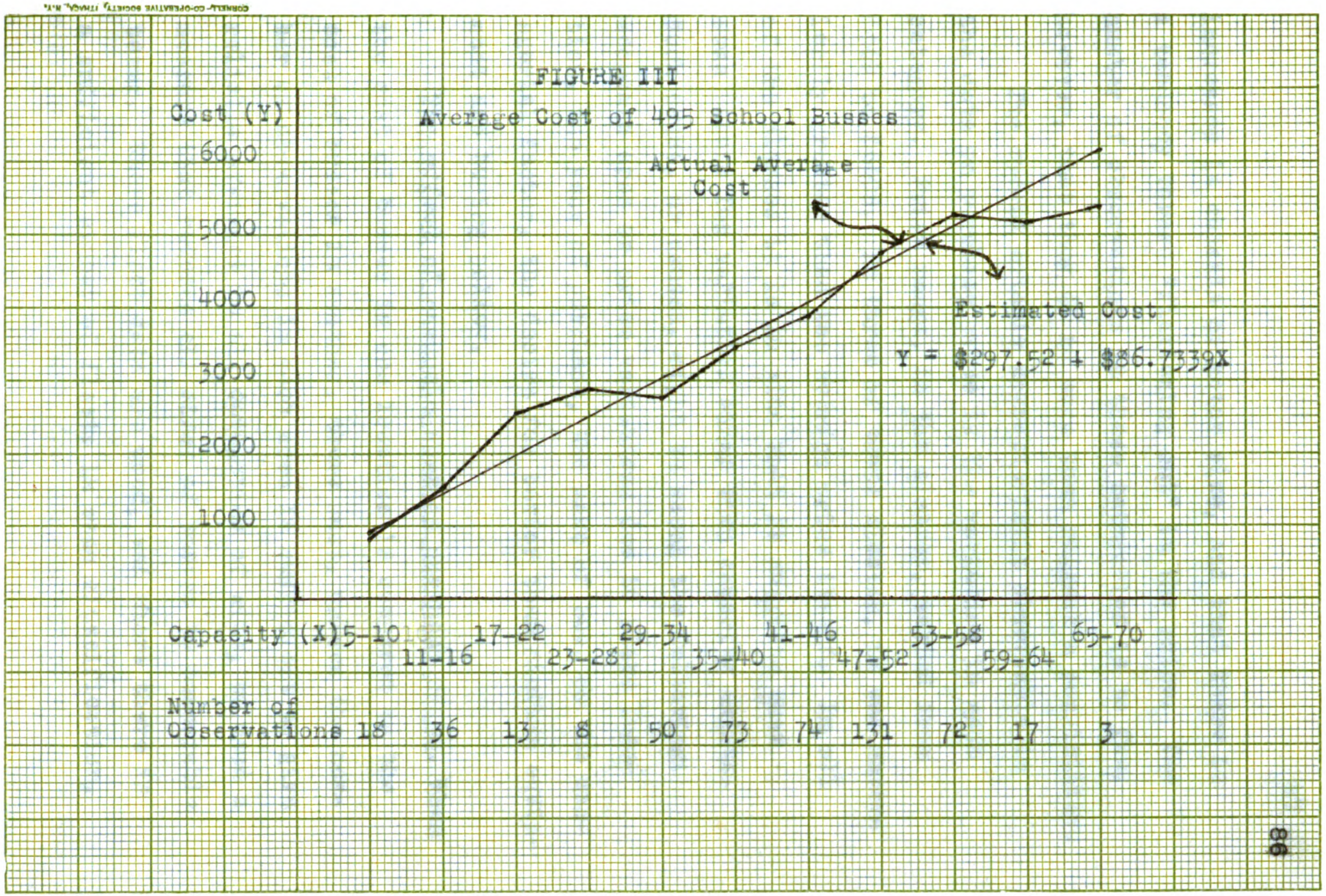
Two characteristics are notable in an examination of this table. One is the consistency of price increase with size. If the categories 17-22, 23-28,

TABLE XII

PURCHASE PRICE OF 495 SCHOOL BUSSES
OPERATED IN 74 CENTRAL DISTRICTS, 1939-40

Class (Capacity)	Number of Busses	Lowest Price	Highest Price	Price Range	Average Price
5-10	18	$600.00	$1048.00	$449.00	$902.74
11-16	36	910.00	3372.00	2472.00	1529.35
17-22	13	1700.00	3000.00	1300.00	2543.78
23-28	8	1717.80	5978.50	4260.70	2899.79
29-34	50	1410.00	4294.20	2884.20	2785.41
35-40	73	1600.00	5020.20	3420.20	3443.06
41-46	74	1800.00	5345.00	3545.00	3892.10
47-52	131	3048.00	7445.00	4403.00	4731.28
53-58	72	3840.00	6555.97	2715.97	5295.60
59-64	17	3325.50	6257.00	2931.50	5171.72
65-70	3	4920.00	5700.00	780.00	5368.33

59-64 and 65-70 are ignored, the relationship is very close to linear. Figure III shows this relationship in graphic form. And it is observable that the four categories in which deviation from linearity is greatest are those in which the least number of observations is found. This would encourage the belief that in the categories 17-22 and 23-28, at least, the number of observations was not sufficient to give trustworthy averages and that a larger number of observations would bring these averages more into line with the others. In the categories 59-64 and 65-70, the possibility of curvilinear relationship should perhaps be considered. It may be that in the larger busses, bigger bodies are used without corresponding



increases in chassis or motor size, and that there is a tendency toward "flattening out" in the price. The number of observations in these categories is to few, however, that they do no more than suggest a possibility.

The second notable characteristic observable in the data on purchase price is the variation in each category. Price range, in the classes, varied from $449 to $4403. In three of these classes, it was numerically greater than the average price itself. In all of the classes it is so wide that it suggests that some cause for variation other than capacity exists. Such cause, or causes, might be among the following: economic area or price variations due to place location, the year of purchase, the make of bus, or the managerial factor, the desire for better than minimum equipment and buying policy.

The effect of economic zone on purchase price. When the cost of busses in one location is compared to the cost of busses in another, there must, unless the number of observations in each area is sufficient to give reliable averages in all categories of size, be used a measure that reduces all sizes of busses to comparable terms. Where fleet data are used, and where there is a sufficient number of fleets in each classification,

variation due to bus size will cancel out and a comparison of per seat costs is valid. Table XIII shows the average per seat cost of busses in districts classified according to economic level, the economic index being the county rate of wages for drivers of trucks on state contract jobs, as set up by the Industrial Commissioner of the state (see pages 71-75).

TABLE XIII

COST PER SEAT OF BUSSES IN 73 CENTRAL DISTRICTS CLASSIFIED ACCORDING TO AN INDEX OF ECONOMIC LEVEL
UNWEIGHTED DISTRICT AVERAGES

Wage Rate on State Contract Jobs	Number of Districts	Number of Busses	Average Cost per Seat
$.55	39	245	$94.44
.60	12	82	92.13
.65	13	104	92.72
.75	6	32	97.82
.875	3	13	95.89
Totals	73	476	(Av) 94.60

The following observations may be made of the data shown in the table.

1. The average of the first group, $94.44, is only slightly less than the average for all groups, $94.60.

2. The averages for the second and third groups, $92.13 and $92.72 respectively, are lower than the average of the first $94.44 and the average of all, $94.60.

3. The two highest group averages, $97.82 and $95.89, are in inverse relationship to each other but are greater than the others and greater than the average of all. The number of observations in these groups is, however, relatively small and the average correspondingly less reliable.

The conclusion drawn from this data is that, as was expected, there is no consistent and measurable relationship between the purchase price of busses and economic area.

Year of purchase. Cost per bus increases with size of bus; cost per seat decreases with size of bus. If the 495 busses of this study were classified according to year of purchase, and seat costs compared, the validity of the result would be impaired by the trend, with the passage of time, toward larger busses. If busses of a single capacity are compared, however, this difficulty is overcome. To compare costs in relationship to year of purchase, therefore, it was decided to use only 49 passenger busses (there were more of these than of any other single capacity in the 495 busses studied). Table XIV shows the purchase price of 100 forty-nine passenger busses purchased, from 1935 to 1940, inclusive.

The table shows a decrease over the previous year of $19.02 in 1936 and of $81.69 in 1940 (note the

TABLE XIV

RELATIONSHIP BETWEEN PURCHASE PRICE AND YEAR OF PURCHASE OF 100 FORTY-NINE PASSENGER BUSSES

Year of Purchase	Number of Busses	Low Price	High Price	Price Range	Average Price	Increase in Price
1935	13	$3163.00	$6008.90	2845.90	4438.22	
1936	20	3048.00	6424.60	3376.30	4419.20	+ 19.02
1937	28	3800.00	6268.50	2468.50	4674.09	+254.89
1938	18	3800.00	5500.00	1700.00	4813.70	+139.61
1939	18	3543.00	6225.00	2682.00	5157.36	+343.66
1940	3	4870.00	5487.00	617.00	5075.67	- 81.69
	Net increase in price, 1935-40, $637.45					
	Average annual increase				106.24	

extremely limited number of observations in the latter year) but positive increases in all other years with a net increase over the period of $637.45 with an average annual increase of $106.24. There is a relationship between cost and year of purchase, with an upward trend over the six years from 1935 to 1940. That it was or will be constantly upward is not to be inferred. A general economic index would be of use in measuring and predicting yearly trends in bus costs. Table XIV shows something else of significance, however. While there has been an average annual increase of $106.24 in purchase price, this accounts for only

a small part of the variation in purchasing costs. In any given year, the range in price is, relative to the annual variation, enormous, varying from $617 in 1940 when only 5 busses were purchased to $5576.60 in 1936. Some variable other than year of purchase must be sought.

Make of bus. If size of bus is an accompanying factor in an examination of the relationship of cost and year of purchase, it is even more noticeable an accompanying factor in a study comparing costs of different makes. Most small busses are Fords, Chevrolets or Dodges; most larger ones are Brockways, Internationals, Macks or Whites. The time element also enters as an accompanying factor, the trend being away from certain makes toward others. Therefore, despite the recognized danger in numerically limiting the data, it was decided that the best comparison of makes was to be made by examining costs of a single capacity size, purchased in a single year. Table XV shows the cost of 25 forty-nine capacity busses purchased in 1937, classified by make of chassis and body. Chassis makes are signified by Roman numerals, body makes by capital letters. There seems to be, as far as the limited data can indicate, a slight difference in price due to chassis

make, chassis IV being the lowest priced and II the highest priced with I and III coming between in that

TABLE XV

CHASSIS AND BODY MAKE AND PURCHASE PRICE OF 25 FORTY-NINE PASSENGER BUSSES PURCHASED IN 1937

Chassis Make	Body Make	Number of Busses	Price			
			Low	High	Range	Average
I	A	3	$4361	$4500	$139	$4454
I	B	5	4100	5150	1050	4700
II	A	6	4201	5317	1116	4770
II	B	2	5000	5225	225	5113
III	B	2	3800	6269	2469	5035
IV	A	5	4200	4650	450	4434
IV	B	2	4295	4500	205	4398

order. And of the bodies, those marked B seem slightly higher priced than that marked A. But, as with year of purchase, the significant variations are not between makes. These are slight compared to the variations within the make groups, which vary from $139 to $2469.

Managerial practices. There are large variations in bus price that are not attributable to size of bus, economic area, year of purchase, or make of bus. There is no list price on busses. Every one is, in effect, a special "job" with varying chassis and body makes,

variations in motive power, weight and length of chassis, type of upholstery and quality of fittings and accessories. To determine what part of those variations are necessary requires a technical knowledge not at commend here. Certainly hilly routes require more powerfully engined busses than do level routes. But it is equally certain that, when, for example, forty-nine passenger busses vary in price from $3048 to $6424.60 as shown in Table XIV, and when all of them meet the state minimum standards, that a large part of the variation is due either to the purchase of power plants, safety and comfort qualities in excess of minimum standards, or to the method of receiving bids and placing orders. These are the variations attributable to "managerial practices." That there are excesses is highly probable, might even be said to be obvious. Transportation is, however, still in the developmental stage and average practice, rather than minimum practice, permits that maneuverability necessary to meet special situations and to make progressive improvement possible.

The calculation of depreciation. On page 83 it was shown that the relationship between size of bus and cost was probably linear. An estimated reasonable cost for each category of bus size is then obtainable

by solving the straight line equation Y = a + bX, when Y equals the cost of bus and X equals seating capacity. In the development of the regression equation, the average price of each class of capacity was weighted for the number of busses in that capacity, the resulting regression being:

$$Y = \$297.52 - \$86.7333X$$

By application of this formula, estimated costs were found for each capacity class of bus as in Table XVI.

TABLE XVI

ESTIMATED REASONABLE COST OF SCHOOL BUSSES
(WEIGHTED STRAIGHT LINE REGRESSION)

Capacity	Number of Busses	Average Actual Price	Estimated Price
5-10	18	$ 902.74	$ 948.02
11-16	36	1529.35	1468.43
17-22	13	2543.78	1988.83
23-28	8	2899.79	2509.23
29-34	50	2785.41	3029.64
35-40	73	3443.06	3550.04
41-46	74	3892.10	4070.44
47-52	131	4731.28	4590.85
53-58	72	5295.00	5111.25
59-64	17	5171.72	5631.65
65-70	3	5368.73	6152.06

From the estimated reasonable cost of school busses, depreciation charges were calculated. On pages 58-59, it was indicated that 10 years was a reasonable life expectancy for school busses. The age and the

utilization of busses in service in 1940 are cited in support of that decision.

TABLE XVII

AGE OF 495 SCHOOL BUSSES IN OPERATION IN 74 NEW YORK STATE CENTRAL SCHOOL DISTRICTS, 1940

Age in Years	Number of Busses
New	23
1	121
2	85
3	103
4	61
5	49
6	16
7	7
8	11
9	16
10	3

At first glance, the heavy preponderance of busses five years old or less and the relatively few 9 or 10 years old seem to indicate that 10 years is too long a period for reasonable expectancy. Centralization is still new in New York State. Of the 283 districts in existence in 1939-40, only 82 were 10 or more years old; 123 of them were less than 5 years old. The above table does indicate that busses can and are used for as long as 10 years.

Table XVIII shows the average total mileage of

486 school busses during the school year ending in June 1940. The mean mileage was 8045. Manufacturers give,

TABLE XVIII

UTILIZATION OF 486 CENTRAL SCHOOL BUSSES IN 74 NEW YORK STATE DISTRICTS, 1939-40

Annual Mileage	Number of Busses
Less than 4000	27
4000-4999	29
5000-5999	57
6000-6999	75
7000-7999	79
8000-8999	70
9000-9999	45
10000-10999	38
11000-11999	20
12000-12999	22
13000-13999	5
14000-14999	8
15000-15999	4
16000-16999	3
17000 and over	4
Mean Mileage 8045	

as a reasonable use expectancy for school busses, 150,000 miles. The table indicates that only 11 busses of 486 or 2.1% give that mileage in 10 years. The average bus gives but little over half the reasonable use. The low utilization figures, improved bus construction and improved roads indicate 10 years as not too long a life expectancy, and suggests also that greater economy can be achieved by a reorganization

of transportation programs so that use and time expectancies will more nearly coincide.

Interest. It was not possible to approach a reasonable interest cost through interest expenditures, as explained on page 59. Consultation with the Director of Public School Transportation in the State Department of Education indicated that purchases were made on borrowed funds and capital debts discharged in 5 years. Assuming the usual procedure of discharging the principal debt in five equal installments and an interest rate of 4%, total interest payments amount to 12% of the capital investment. This amount was amortized over a ten-year period.

Insurance. Part of the variation of bodily injury and property damage liability insurance is dependent on size of bus, as shown in Table XIX.

TABLE XIX

STATUTORY REQUIREMENTS
LIABILITY INSURANCE FOR PUBLIC VEHICLES

Capacity of Vehicle	Relation to Basic Rate	Bodily Injury Coverage	Property Damage Coverage
0- 7	100%	2500/ 5000	1000/5000
8-12	130%	5000/15000	1000/5000
13-20	139%	5000/25000	1000/5000
21-30	149%	5000/40000	1000/5000
30 or more	153%	5000/50000	1000/5000

From this information and from the basic rates (the rates on privately owned passenger cars) of the Massachusetts Mutual Insurance Company, the cost of insurance of each size of bus in each insurance zone was calculated, the average cost for each size bus for all zones determined, and the difference due to size of bus (see Table XXXIII). The differential due to capacity of bus is best used in that part of a formula dealing with costs totally dependent on capacity, the capital costs, and is shown as a correction figure.

Reasonable capital costs. With the calculated reasonable cost of equipment, interest on capital investment and the correction figure for that part of the variation in insurance due to capacity, reasonable capital costs were determined.

TABLE XX

REASONABLE CAPITAL COST FOR THE OPERATION OF SCHOOL BUSSES

Capacity of Bus	Depreciation	Interest on Investment	Insurance Correction	Capital Cost
5-10	$ 94.80	$11.38	$-23.44	$ 82.74
11-16	146.84	17.62	-20.65	143.81
17-22	198.88	23.87	-20.65	202.10
23-28	250.92	30.11	-17.54	263.49
29-34	302.96	36.36		339.32
35-40	355.00	42.60		397.60
41-46	407.04	48.85		455.89
47-52	450.09	55.09		514.18
53-58	511.13	61.34		572.47
59-64	563.17	67.59	+20.27	651.02
65-70	615.21	73.82	+20.27	709.30

Contract costs. The contract costs, wages, rent and insurance, were defined as varying with place location. While they were examined from this point of view, other possible causes of variation were not ignored but were studied carefully. The findings are reported in the following pages.

Wages. The 1939-40 contract wage of each of the drivers in 74 districts was obtained from the permanent files of the State Department of Education. Two types or fields of variation were observable, variation within the districts and variation between the districts. Thirty-nine of the 74 districts recorded a constant wage for all drivers. The 35 districts reporting variations were questioned as to their wage policies; twenty-three submitted answers. Table XXI gives a summarization of the findings.

TABLE XXI

WAGE POLICY IN 74 NEW YORK STATE CENTRAL SCHOOL DISTRICTS

Policy	Districts
Constant wage rate	39
Variation -- driver acting as mechanic	11
Variation -- driver making extra trips	6
Variation -- longer or more difficult routes	2
Variation -- driver housing bus	2
Variation -- the result of annual increments	1
Variation -- work not connected with transportation	1
Variation -- unexplained	12

Thirty-nine, or over half of the districts, paid constant wage rates; fourteen reported increments for added service, eleven for acting as mechanics, two for housing busses and one for extra service not connected with transportation; nine reported wage differentials because of longer or more arduous routes or extra driving, length of service. Where differentials were due to non-driving extra service, they were reduced, and the differences transferred to other items of expense. For example, the differentials due to the driver's acting as mechanic was transferred to the repairs and maintenance account; that paid for housing busses was transferred to the rent account. For inter-district study, the wages in districts with irreducible variations were averaged.

Wages in the 74 districts varied from $380 to $1000 with an average of $575, as shown in Table XXII.

TABLE XXII

WAGES PAID TO SCHOOL BUS DRIVERS IN 74 NEW YORK STATE CENTRAL DISTRICTS

Wage Paid	Number of Districts
$ 380-399	2
400-499	13
500-599	28
600-699	22
700-799	4
800	4
1000	1
Average $575	Range $620

The most striking feature of the table presented above is the wide range in wages, a condition in which some districts pay almost three times as much as others for apparently the same service. This wide range of $620 dollars from the low to the high wage might be explained by the fact that in some districts the routes are longer than in others, by the higher levels of cost in different economic areas with its reflection in wage costs, or by the managerial factor, the desire for a higher quality of driver service and the willingness to pay for it.

Drivers' wages and total annual mileage. Mileage was given as a possible cause for variation in wage levels. The average mileage per bus in each district was determined and the relationship between that and wages examined.

TABLE XXIII

RELATIONSHIP BETWEEN WAGE RATES FOR DRIVERS AND TOTAL ANNUAL MILEAGE IN 74 CENTRAL DISTRICTS

Wage	Number of Districts	Low Mileage	High Mileage	Range	Average
380- 499	15	4460	11315	6855	7239
500- 599	28	5052	11025	5973	8085
600- 699	22	5300	13125	7825	8297
700-1000	9	5580	11822	6242	8405

The table shows an apparent relationship between wages

and total mileage, seemingly of a curvilinear nature. On the basis of reason this would not seem to be a chance relationship, but the variation of mileage within the classes makes it impossible to estimate wage in terms of mileage. The spread in wages, using the midpoints of the classes as measuring points, is $430; the spread in average mileage is 1166 miles. To interpret 1166 miles as a cause of a wage differentiation of $450, when mileage differences, within the classes, of from 5 to 7 times as great (6855, 5973, 7825 and 6242) are not attended by wage differences, is inconsistent with the obvious facts. Total mileage accounts for only a small part, if any, of the variation in wage.

Wages and economic area. Economic area was suggested as a second possible cause for wage variation. On pages 71-75, a discussion of county indexes of cost indicated that the different indexes available were not consistent with each other, that any attempt to combine them destroyed their individual value, and suggested that the county wage scale for truck drivers on state contract jobs provided the best index. As a check on the selection , actual wages were compared to the state contract scale and to the W. P. A. wage scale

with the results summarized in Table XXIV.

TABLE XXIV

RELATIONSHIP OF WAGES PAID BUS DRIVERS TO THE STATE CONTRACT WAGE SCALE AND TO THE W. P. A. WAGE SCALE

State Contract Wage Scale	Drivers' Wage	W. P. A. Wage Scale	Drivers' Wage
88	$723	130	$606
75	612	120	555
65	570	110	572
60	545	100	609
55	572		

The table shows that there is no relationship between the W. P. A. wage scale and bus drivers' wages as they are paid in the districts. There does, however, seem a fairly consistent relationship between the state scale for contract drivers and school bus drivers' wages with a range in drivers' pay that seems highly significant. Use of the contract wage scale as a measure of variation in cost levels seems justified by the established relationship.

Estimated reasonable wage for school bus drivers. With an index of cost levels chosen, it was next necessary to find a mathematical technique that would give a range or spread of estimated wages comparable to the scale itself and reasonably close to the range in

actual wages paid. A regression, weighted for the number of districts in each economic area, was solved to get estimated reasonable wage. The range of this scale was not comparable either to that of the wage index or to the range in wages as indicated in Table XXIV. It was felt that the large number of observations in the lowest economic group upset the balance of the weighted regression, so an unweighted regression was tried. This showed an improved range but still one that fell short of the range of either the index or actual wages. In a third attempt to estimate reasonable wage, the relationship between the average economic index of all the districts and the average wage of all the districts was determined and a wage proportionate to each index level calculated. The three scales are shown in Table XXV. Of them all, the third or proportional scale was selected as having the better range and the greatest value in estimating wages in county zones.

TABLE XXV

ESTIMATED WAGES OF BUS DRIVERS
IN AREAS CLASSIFIED ACCORDING TO ECONOMIC LEVEL

State Contract Wage Scale	Average Wage Paid	Est. Wage Weighted Regression	Est. Wage Simple Regression	Direct Proportion to County Index
88	$723	$665.14	$701.82	$839.26
75	612	623.15	637.21	715.28
68		600.54	602.42	648.52
65	570	590.85	587.51	619.91
63		584.39	577.57	600.83
60	545	573.70	562.66	572.22
55	572	568.55	537.81	525.54

Rent. Busses are variously housed in New York State. Sixty-four of the 74 districts studied reported on the manner of housing their busses, the reports summarized as follows:

TABLE XXVI

METHOD OF HOUSING SCHOOL BUSSES
IN 64 CENTRAL SCHOOL DISTRICTS

Method of Housing	Number of Districts
School storage	38
Stored partly at school partly in outside quarters	8
Stored in rented space	16
Housed by drivers	3

Thirty-eight of the districts housed their own busses. Twenty-seven housed them either wholly or partially in outside quarters. Because of the difficulty involved

in segregating the capital costs, heat and lighting of school garages from the general accounts, estimated rent costs were determined from unquestioned rent expenses, those paid by districts who rented outside housing space. Twenty-five of the districts recorded costs, summarized in the following table.

TABLE XXVII

RENTS PAID BY 25 CENTRAL SCHOOL DISTRICTS HIRING OUTSIDE SPACE, 1939-40

Number of districts	Rents paid per bus
2	$250 - 233
4	121 - 150
6	100 - 120
8	80 - 99
4	50 - 79
3	25 - 49
Average $107	Range $183

The rent charges per bus varied from $25 to $233 with an average of $107. Possible causes for variation were size of bus and economic area. Size of bus was, however, rejected when it was found that schools rented a given floor space, the number or size of busses not a consideration in price, and where busses were housed with drivers, an identical amount was paid regardless of size of bus. The districts were then classified according to economic zone and a possible relationship

between rents and the economic index sought.

TABLE XXVIII

RELATIONSHIP OF RENT PAID TO STATE CONTRACT WAGE SCALE IN 25 CENTRAL SCHOOL DISTRICTS

Number of Districts	State Contract Wage Scale	Rent Paid
4	75	$119
5	65	79
6	60	110
10	55	115

There was obviously no consistent relationship between rents paid and the index of economic level. There are several reasons why this should be so: (1) the extremely limited number of cases for observation, (2) the fact that some districts rented heated space, some unheated space, with a probable difference in price, (3) where drivers were paid for housing busses, the rent paid was comparatively low, and (4) the presence here, even more noticeably than in other cost items, of a variation explainable only in terms of the willingness on the part of some boards of education to pay more for a given service.

In spite of the fact that there was no observable relationship between rents and economic area, it was felt that logically such a relationship should exist,

and a scale of estimated reasonable rents was prepared by the process of averaging rents and indexes of economic level and calculating rents on a proportionate basis, as was done with wages.

TABLE XXIX

ESTIMATED REASONABLE RENT CHARGES PER BUS
BASED ON STATE CONTRACT WAGE SCALE

State contract wage scale	Estimated rent
88	$151.36
75	129.00
68	116.96
65	111.80
63	108.36
60	103.20
55	94.60

Insurance. Estimated costs of insurance were made directly from the published rates of the mutual insurance companies. New York State is divided into 45 insurance zones, 16 of which cover the rural areas of the state described in terms of county and town lines and exclusive of cities. The insurance rate books quote basic rates on three sizes of conveyance, 0-30, 30-60, and 60 or more passenger places, in each zone of the state. Further differentiation is brought into being by the fact that public conveyances are charged in excess of the basic rate according to capacity and

are required to carry a coverage in excess of the minimum, as indicated in Table XXX.

TABLE XXX

STATUTORY REQUIREMENTS FOR LIABILITY INSURANCE COVERAGE AND RATES ON PUBLIC CONVEYANCES

Size of Bus	Required Coverage	Cost Rates
0- 7	2500/ 5000	Basic rate
8-12	5000/15000	130% of basic rate
13-20	5000/25000	132% " " "
21-30	5000/40000	148% " " "
30 and more	5000/50000	153% " " "

None of the schools may carry less than the statutory requirements. Actually, many carry in excess of it. Thirty-nine schools reported insurance coverage on busses of medium size (30 to 60 capacity) as follows:

TABLE XXXI

COVERAGE PROVIDED ON BUSSES 30-60 CAPACITY IN 39 CENTRAL DISTRICTS

Number of Districts	Coverage Provided
7	5,000/ 50,000
2	5,000/100,000
1	5,000/200,000
2	5,000/300,000
6	10,000/100,000
2	10,000/200,000
1	10,000/335,000
1	10,000/385,000
1	15,000/200,000
3	20,000/100,000
2	20,000/200,000
2	25,000/100,000
2	25,000/200,000
2	25,000/300,000
4	50,000/100,000
1	50,000/200,000

Insurance agents gave assurance that the minimum coverage required under the statutes was sufficient coverage. This seemed to be born out by the record of 50 central districts reporting accidents in 1939-40. Forty-three of these reported the transportation of 13,064 pupils daily without accident. Six districts, transporting 1,630 pupils, reported 6 injuries, one in each district, none of them being sufficiently serious to require the attention of a physician or surgeon. One district, transporting 768 pupils, reported one injury that required the services of a physician. No deaths were reported. Given the basic rates of the mutual companies, the statutory requirements for coverage, and the variation in costs due to size of bus, the cost of minimum coverage insurance was calculated for categories of bus size and in each of the rural insurance zones of the state, property damage and bodily insurance being included. Table XXXII shows the calculation.

The size classification set up by the insurance companies and that used in this study do not exactly coincide. There is very little overlapping, however, and costs are reasonably accurate. From this table it is possible to determine (a) the cost of insurance on average size busses in each county, for use in the

Zones	5 Bodily Injury	5 Pr Dam	59-70 Bodily Injury	59-70 Prop. Damage	59-70 Total
6	54.47	9.	115.36	12.20	127.56
10	49.49	7.	102.43	9.45	111.88
20	39.85	7.	79.56	9.55	89.11
22	41.65	6.	77.57	8.70	86.27
23	35.87	6.	76.73	8.70	85.43
24	44.34	8.	87.52	10.85	98.37
26	37.04	6.	79.18	8.70	87.88
28	47.03	6.	87.52	8.70	96.22
31	45.70	6.	86.52	9.25	95.77
32	39.49	5.	77.57	7.35	84.92
33	36.04	6.	76.58	8.70	85.28
36	36.04	6.	76.58	8.70	85.28
38	43.12	8.	76.58	10.90	87.48
40	35.87	6.	76.73	8.70	85.43
41	36.04	6.	76.58	8.70	85.28
43	36.04	5.	77.11	8.70	85.81
44	36.04	5.	76.58	7.35	83.93
45	32.24	5.	68.62	7.35	75.97
Averages					90.99
Deviations from a capacity bu					+20.27

contract cost schedule, and (b) the average difference due to capacity of bus, which was used as an insurance correction factor in the capital cost schedule (see Table XX).

Under a fleet insurance clause, a deduction is allowable when the number of busses exceeds five. This allowance, expressed as a percentage of the calculated cost of insurance on a single bus, is given in Table XXXIII.

TABLE XXXIII

PERCENTAGE DEDUCTION FROM COST OF INSURANCE FOR PURCHASE ON A FLEET BASIS

Size of Fleet	Percentage Deduction	Size of Fleet	Percentage Deduction
6	1.7	14	6.4
7	2.9	15	6.7
8	3.8	16	6.9
9	4.4	17	7.1
10	5.0	18	7.2
11	5.5	19	7.4
12	5.8	20	7.5
13	6.2		

The rate books of mutual companies were also examined for the statutory requirements and rates for employees compensation insurance. The rate is $2.58 per hundred of payroll with a minimum of $51.00. The cost of compensation was determined on the estimated wage per

driver in each economic zone.

Contract costs. With estimations of reasonable wages for school bus drivers, rent and insurance costs in economic zones and insurance zones of the state, total reasonable contract costs were calculated for each county for which data were gathered. Such total contract costs must be corrected for the deduction in insurance for size of fleet. (Table XXXIV)

Variable costs. The variable costs of school bus operation are the costs of gas, oil, tires, chains and accessories, repairs and maintenance. These, for the 1939-40 school year were reported to the State Department of Education in the Application for Transportation Quota, the data for this study being taken from the reports of 74 selected districts. It was desired to calculate, from this data, the cost of operating each bus. Difficulty arose, however, from the manner in which these costs were reported.

Gasoline and oil consumption was reported for each bus, but the expenditure for tires, chains and accessories, repairs and maintenance were reported as total fleet expenditure only. Considerable variation in the method of accounting, as regards these latter expenses, was noticeable. Some of the districts reported all such

TABLE XXXIV

ESTIMATED TOTAL CONTRACT COSTS OF OPERATING SCHOOL BUSSES IN COUNTIES BASED ON AN INDEX OF ECONOMIC LEVEL AND INSURANCE COSTS

County	Contract Wage Scale	Insurance Zone	Wages	Rent	Liability Insurance	Employees' Compensation	Total Contract Cost
Albany	68	45	$648.52	$116.96	$58.59	$16.73	$824.07
Allegany	55	44	524.54	94.60	64.63	13.53	697.30
Broome	65	45	619.91	111.80	58.59	15.99	806.29
Cattaraugus	60	44	572.22	103.20	64.63	14.76	754.81

expenses under the heading of repairs, others reported them all as maintenance costs. This presented no major difficulty since they may all be combined and used as a unit under the general heading of variable costs. This is the manner in which they were treated in this study.

A greater difficulty lay in the impracticability of apportioning the reported fleet costs to the busses accurately. The primary factors underlying the variable costs are size of bus and mileage. Whether, mileage being constant, the variable costs will vary in exact proportion to the number of seats, cannot be known until a sufficient number of districts keep a record of these costs for each bus. However, the seat-mile has been used as a measure of cost in a number of studies, is reasonably accurate, and is used here. In spite of this, it is a fact that any attempt to allocate variable fleet costs to the busses on the basis of the seat-mile has the effect of nullifying and concealing the effect of the route factors: type of road and number of stops. However, if it is impossible accurately to convert fleet costs to bus costs, the alternate process is perfectly feasible. This is the method followed here. The difficulty encountered

in analyzing variable costs arises, however, out of inadequate accounting procedure and suggests the need for uniform and accurate accounting methods to give the administrator the detailed knowledge of transportation costs necessary to effective planning and budgeting.

Variable costs per seat-mile. The cost per seat mile is small. For ease in study and comparison, 1000 seat-miles was used as the unit of cost and computed to the nearest mill for each district. The cost and variation in cost in 72 central districts is shown in the following table:

TABLE XXXV

VARIABLE COST OF OPERATING SCHOOL BUSSES IN 72 CENTRAL SCHOOL DISTRICTS

Class Limits	Number of Districts	Operating Costs per 1000 Seat-miles
50- 80	14	$ .713
80-100	22	.889
100-120	13	1.099
120-150	12	1.326
150-280	11	2.090
High	$2.789	Range $2.230
Low	.559	Average 1.149

The average variable cost per 1000 seat miles was $1.149; the range $2.230, from a low cost of $.559 to a high cost

of $2.789. This wide variation, in which the cost in one district is almost 5 times that in the district at the other extreme, is explainable by variation, in the several districts, of cost levels (the economic factor), depth of snowfall, the route factors (number of stops and type of road) or in managerial practices. The affecting factors were examined in that order.

Economic area. Economic area, or differing cost levels due to spatial location, is reasonably a factor in variable costs, especially through the labor costs of repairs and maintenance. Where schools had repair and maintenance work done by outside agents, labor costs were reported under the repair and maintenance accounts. Where it was done by bus drivers who were also paid as mechanics, it was reported as driver's wage. In these cases, the excess in wage over that of other drivers and attributable to labor as a mechanic was transferred from drivers' wages to the repair and maintenance accounts. The districts were classified according to economic area and costs determined for each classification.

TABLE XXXVI

RELATIONSHIP BETWEEN ECONOMIC INDEX AND VARIABLE COSTS OF OPERATION IN 72 CENTRAL DISTRICTS

State Contract Wage Scale	Number of Districts	Variable Operating Costs per 1000 Seat-miles			
		Low	High	Range	Average
55	39	$ .559	$2.789	$2.230	$1.135
60	11	.624	2.573	1.949	1.162
65	13	.767	2.099	1.332	1.113
75	6	.668	1.809	1.141	1.204
87½	3	1.194	1.859	.665	1.352

Examination of the last, average column shows a small but relatively consistent increase in variable cost per seat-mile with the index of economic level. With the exception of the third or middle group of observations, each succeeding group shows an increase nearly in proportion to the increase in the value to the index, there being a total increase of $.219 or an average increase of $.025 per 1000 seat-miles for each five points on the economic scale. Such an increase in costs would make a difference, between any two levels except the last, which has a greater interval, of $8.25 per year in operating the average bus over the average annual mileage. But when the large range in variation within each class is noted (ranges from $.665 to $2.230, with an average range of $1.448), the comparative insignificance of a variation

between economic levels of $.025 is forcibly brought to notice. Economic area may be and probably is a factor in the variation of costs, but further study with closer control of other causes of variation than is possible here is necessary.

Average annual snowfall. Snowfall has not been proved a causal factor in the cost of transportation. It varies, however, so widely in New York State, from a yearly average of 15 inches to one of 188 inches, that study of it seemed justified. Seventy-three districts were classified as to average annual snowfall (see pages 69-71 and Figure III) and average variable cost per seat-mile for all the districts in each classification found.

TABLE XXXVII

RELATIONSHIP BETWEEN AVERAGE ANNUAL SNOWFALL AND VARIABLE COSTS OF OPERATING SCHOOL BUSSES IN 73 CENTRAL DISTRICTS

Average Snowfall	Number of Districts	Variable Operating Costs per 1000 Seat-miles			
		Low	High	Range	Average
20-54	18	$.624	$1.859	$1.235	$1.125
54-95	35	.559	2.789	2.230	1.163
95-160	10	.574	2.729	2.155	1.136

Table XXXVII shows no consistent relation between annual snowfall and variable costs of school bus

operation. The inconsistent increase, with the average cost in the area of deepest snow less than the average of all districts,$1.149, and with the enormous variation within each of the classes, show that snowfall is of little or no effect on cost. Snow removal policies probably are more important in their effect on costs than average snowfall itself. Another factor tends to obscure a relationship between snowfall and costs, if such a relationship does exist. The heavy snowfall areas are, in general, the low economic level areas, where cheaper labor costs in maintenance and repairs would tend to offset any increase in operating costs because of snowfall. It is impossible, with the data at hand, to separate the single effect of snowfall.

Number of stops. The number of stops made by a bus has consistently been given as a factor in the cost of bus operation. It was dealt with in this study, on a district basis (costs being dealt with effectively on that basis only). Information regarding the number of stops was sought by questionnaire to the districts. Sixty-four districts returned the questionnaires, 58 of them submitting information regarding number of stops. The total number of stops per district was determined. Then, because of the widely differing lengths

of route, number of stops was converted to stops per mile. Stops per mile varied widely, as shown

TABLE XXXVIII

NUMBER OF STOPS PER MILE
IN 58 CENTRAL DISTRICTS

Stops per Mile	Number of Districts	Stops per Mile	Number of Districts
.3	1	1.2	3
.4	6	1.3	2
.5	5	1.4	4
.6	6	1.5	2
.7	8	1.7	4
.8	4	1.9	2
.9	4	2.3	1
1.0	3	3.0	1
1.1	2		

Low 0.3 High 3.0 Average 1.0

The number of stops per mile varied from 0.3 to 3.0 with an average of 1.0. The relationship between number of stops and variable operating costs per seat-mile is shown in Table XXXIX. Several classifications of districts according to stops per mile were made, none showing a stable relation between stops and cost; a division into three classes was finally made as being the largest number that would provide valid averages.

Examination of Table XXXIX shows a non-consistent increase in costs as the number of stops increase. The

net increase from $1.086 to $1.142 is $.056 with an average increase of $.028, with the high cost of the middle group, $1.194, casting doubt on the relationship. The obscurity of the relationship may be due to the few cases involved, to interrelationships between number of stops and other factors, as type of road, or, as the extremely wide variation in costs within each group indicates, to the existence of some other factor affecting costs that conceals the probable relationship between costs and number of stops.

TABLE XXXIX

RELATIONSHIP BETWEEN STOPS PER MILE AND VARIABLE COSTS OF OPERATING SCHOOL BUSSES IN 58 CENTRAL DISTRICTS

Stops per Mile	Number of Districts	Variable Operating Costs per 1000 Seat-miles			
		Low	High	Range	Average
.3- .6	18	$.624	$2.523	$1.899	$1.086
.7-1.2	24	.574	2.729	2.155	1.194
1.3-3.0	16	.559	2.789	2.230	1.142

Type of road. Type of road, generally conceded a factor in transportation costs, was also examined for its relationship to seat-mile costs. Chapter III describes the classification of roads used in this study and the calculation and application of a road index. The questionnaire to the districts asked the mileage

on each class of road for each route. Sixty-three districts supplied the information, classifying a total of 14,866 route miles as follows:

TABLE XL

ROUTE MILEAGE ON TYPES OF ROAD
IN 63 CENTRAL DISTRICTS

Class of Road	Description	Route Mileage
A	Concrete & Macadam in good repair	8693
B	Broken Macadam and good gravel	3433
C	Gravel in poor condition and dirt	2740

The general excellence of New York State roads is noticeable. Less than a fifth of the total mileage was listed as class C road, only a little more than two-fifths as classes B and C combined. For study in relationship to cost, route mileage was combined to give district mileage over each class of road and this was, in the manner described on pages 67-68, converted to an index type of road.

Road index varied from 0 (three of the districts operated entirely over class A roads) to 61, with an average of 27. A district operating entirely on class B road would have an index of 40. It is of interest to note that 13 districts only,

or 21% have an index as high or higher than that.

TABLE XLI

CLASSIFICATION BY ROAD INDEX OF DISTRICT ROUTE MILEAGE IN 62 CENTRAL DISTRICTS

Road Index	Number of Districts
0- 9	9
10-19	16
20-29	12
30-39	12
40-49	4
50-59	8
60-69	1
Low 0	Median 25
High 61	Average 27

Relationship to cost was studied by grouping districts into classes according to road index and averaging seat-mile costs for each of the classes, three classes again being deemed the largest number to provide valid averages.

TABLE XLII

RELATIONSHIP BETWEEN CLASS OF ROAD AND VARIABLE COSTS OF OPERATING SCHOOL BUSSES IN 62 CENTRAL DISTRICTS

Road Index	Number of Districts	Variable Operating Costs per 1,000 Seat-miles Low	High	Range	Average
0-19	25	$.559	$2.729	$2.170	$1.165
20-39	24	.574	2.789	2.215	1.140
40-61	13	.704	2.523	1.819	1.246

The above table shows an average cost of operating, per 1000 seat-miles, of $1.165 for districts with a road index of less than 20; a cost of $1.140 for districts with indexes between 20 and 40; and a cost of $1.246 for districts with an index of 40 or more. The relationship between type of road and cost is not clearly or consistently shown. A net increase in cost from class A to class C road, however, is $.081, with an average increase of $.041. A lack of consistency in the relationship may be attributed either to the lack of data, the interrelationship between type of road and other factors, as number of stops, or to the obvious existence of some other factor affecting costs, indicated by the wide variation in costs within the classes (note the intra-class ranges of $2.170, $2.215 and $1.245).

Combined effect of type of road and number of stops. It was suggested in the preceding paragraphs that interrelationships between type of road and number of stops per mile might tend to conceal the effect of either. This would be true if busses stopped more frequently on good roads than on poor roads where population is apt to be less dense. The probable existence of such a circumstance is indicated in

Table XLIII.

TABLE XLIII

RELATIONSHIP BETWEEN TYPE OF ROAD AND NUMBER OF STOPS PER MILE IN 58 CENTRAL DISTRICTS

Number of Districts	Road Index	Number of Stops
23	0-19	1.1
24	20-39	1.0
11	40-61	.6

The above table indicates a probable relationship between type of road and number of stops to the effect that as road index increases (tending toward an increase in costs), the number of stops tends to decrease (tending toward a decrease in costs). To measure more exactly the relationship between number of stops, type of road and costs per seat-mile, a multiple regression equation involving those three variables was calculated as follows:

$$X_1 = \$.021245X_2 - \$.001775X_3 - \$1.077947$$

In the above equation, X_1 equals the cost per 1000 seat-miles, X_2 equals the number of stops per mile and X_3 equals the type of road as measured by the index.

This equation was applied to two imaginary cases representing extremes in number of stops and type of road to find the probable maximum cost difference

attributable to route factors. Both examples were made to show a constant size of bus, length of route and number of days operated. The first assumes all class A road and a minimum of stops.

Problem 1.	Bus capacity	42
	Route mileage	30
	Days operated	190
	Road index	0
	Number of stops per mile	.5

Calculation of variable costs:

Fixed sum		$1.077947
Stops per mile	.5 x $.021245	.010623
Road index 0 x $.001775		
$\frac{42}{1000}$ x 190 x 30 x		$1.088570 = $260.60

The second problem assumes the opposite extreme as to type of road (index 60) and number of stops (2.0).

Problem 2.	Bus capacity	42
	Route mileage	30
	Days operated	190
	Road index	60
	Number of stops per mile	2

Calculation of variable costs:

Fixed sum		$1.077947
Stops per mile	2 x $.021245	.042490
Road index 60	x $.001775	.106500
$\frac{42}{1000}$ x 190 x 30 x		$1.226937 = $293.73

The difference in annual variable operating costs in these extreme cases was $33.13. That number of stops and type of road in their most extreme variation

can account for so little a variation in cost seems subject to question. Tables XXXIX and XLII showed wide variations in cost not attributable to number of stops or to type of road. It is felt that this so far unexplained variation tends to conceal the effect of route factors. Until further study of the effect of route factors gives results in which greater confidence can be placed, operating costs under average conditions of type of road and number of stops give an annual cost that varies little either way from the cost derived by the regression equation. Average cost per 1000 seat-miles was given in Table XXXV as $1.149. This can be converted into cost per mile for each capacity class of bus (see Table XII), as follows:

TABLE XLIV

AVERAGE VARIABLE OPERATING COST PER MILE FOR SCHOOL BUSSES IN NEW YORK STATE

Bus Capacity	Average Operating Cost per Mile
5-10	$.00862
11-16	.01552
17-22	.02241
23-28	.02930
29-34	.03619
35-40	.04309
41-46	.04998
47-52	.05688
53-58	.06377
59-64	.07066
65-70	.07756

The managerial factor. Constant reference has been made throughout this study of variations attributable to no other cause than managerial practice: variations in price of bus, in wages paid to drivers, in rent, and in variable operating costs. Much of the variation is unquestionably due to the purchase of better equipment and superior services, or to the provision of better transportation service to the community. While it was difficult to believe that variations so wide were entirely explainable by justifiable variations in equipment and service, the data at hand gave no definite basis for question except, in the field of variable costs, in the price paid for gasoline and oil. Variation in prices paid for these supplies is shown in Tables XLV and XLVI.

TABLE XLV

PURCHASE PRICE OF GASOLINE
IN 73 CENTRAL DISTRICTS, 1939-40

Purchase Price (Cents per Gallon	Number of Districts
6.65- 6.99	5
7.00- 7.99	31
8.00- 8.99	15
9.00- 9.99	8
10.00-19.00	14

Gasoline is purchasable by central school districts at

the state contract price fixed by the state division of standards and purchase. The state, in 1939, was zoned with prices varying according to zone but in no case higher than 8.5¢. The table shows many schools paying in excess of the contract price, some actually paying the retail price to the general public.

TABLE XLVI

PURCHASE PRICE OF MOTOR OIL
IN 72 CENTRAL SCHOOL DISTRICTS

Purchase Price (Cents per Quart)	Number of Districts
9.0-11.9	6
12.0-14.9	21
15.0-17.9	14
18.0-20.9	12
21.0-29.9	15
30.0-32.0	8

The schools have the privilege, also, of purchasing motor oil at the state contract price, varying according to zone and weight of oil, but not exceeding $.185 per quart. The table shows many schools buying in excess of that price, some again paying the retail price charged to the public.

Variations in price of this nature seem to be due either to ignorance of buying opportunities or to a preference for buying from local dealers even at a

higher price. That excesses of this kind should be curbed is unquestionable. How they may be controlled without limiting too closely variations in expenditure due to purchase of superior materials and services is not clear. Estimating reasonable costs on average practice and distributing state aid based on those estimates should leave some room for maneuver in the purchase of equipment and services and at the same time discourage the more grave excesses in purchasing practice.

Application of the formula for estimating reasonable costs. Chapter IV, up to this point, has been devoted to an analysis of capital, contract and variable operating costs and estimation of reasonable costs in each field. In conclusion, a transportation problem may be postulated and the use of estimated costs shown in calculating a reasonable cost in a specific situation. Assume the following circumstance:

Location of school	Oneida Co.
Pupils to be transported (involving the purchase of a 45 cap. bus)	42
Daily route mileage	40
Days operated	190

The calculation of reasonable annual costs:

Annual capital costs (from Table XX)	$455.89
Annual contract costs (from Table XXXIV)	790.57
Variable operating costs:	
40 x 190 x $.04998 (from Table XLIV)	379.85
Total reasonable annual cost	$1626.31

If it were desired to use the regression equation for calculation of variable operating costs, instead of the simple average, two further assumptions would have to be made:

Road index (average)	27
Stops per mile (average)	1.0

The calculation would then be:

Annual capital costs (from Table XX)			$455.89
Annual contract costs (from Table XXXIV)			790.57
Variable operating costs			
Fixed sum		$1.077947	
Stops per mile	1.0 x $.021245	.021245	
Road index	27 x $.001775	.047925	
$43 \times \frac{40}{1000} \times 190 \times$		$1.147117	374.87
	Total reasonable annual cost		1621.33

CHAPTER V

THE QUALITY OF TRANSPORTATION SERVICE, ITS MEASUREMENT, AND ITS RELATIONSHIP TO THE COST OF TRANSPORTATION

The preceding chapter dealt with an analysis of the raw costs of school bus transportation and with the estimate of reasonable raw cost. No accounting was made of the real costs, the expenditure in relation to the quality of service provided, beyond the assumption that the quality of service met the requirements set up by the Public Service Commission and the State Department of Education. Nor has any study reviewed by this writer attempted to seek, in quality, a cause for variation in the cost of transportation despite the reasonable supposition that the effectiveness of the service provided, and the quality of the equipment used and of the services purchased for its operation and maintenance will all reflect in the total cost of transportation. This may have been due to a lack of an objective, numerical measure of quality. Such a measure was developed, in 1938, in the Ruegsegger Scale for the measurement of the quality and effectiveness of school bus transportation

(see pages 75-81 and appendix). It is the purpose of this chapter to make an analysis of the quality of the transportation services provided in selected districts, as measured on the Ruegsegger Scale, and to discover any relationship that may exist between the quality of transportation service and its cost.

Validity of the data. The Ruegsegger Scale, already described, measures the quality of service under six headings:

1. The regularity of service.
2. Its convenience to the pupils transported.
3. The degree of comfort provided pupils in transportation.
4. The provisions made for security against injury to pupils.
5. The quality of the conveyance used and of maintenance service.
6. The quality of the driver personnel hired.

Copies of the scale were sent to 59 districts. Because of unusual circumstances existent at the time and of the labor involved in scoring a transportation system, only 13 schools returned completed scores. The writer then visited 27 schools scoring the transportation systems. Complete cost and route data were at hand for these 40 districts. The scores on eleven schools not originally included in this study but scored in

the same school year were included in the analysis to check the reliability of the data gathered.

TABLE XLVII

SCORES OF QUALITY, AS MEASURED ON THE RUEGSEGGER SCALE, IN 40 AND IN 51 CENTRAL DISTRICTS

	Low Scores		High Scores		Average Scores	
	40 Dist.	51 Dist.	40 Dist.	51 Dist.	40 Dist.	51 Dist.
Regularity	117	102	135	135	128.3	129.2
Convenience	85	72	120	120	108.4	110.3
Comfort	88	80	110	110	103.0	104.7
Security	135	135	200	200	161.9	162.0
Conveyance	134	134	225	225	195.2	194.9
Personnel	135	135	201	201	172.7	171.6
Total Quality	793	793	964	964	870.0	872.0

It is observable, from an examination of the above table, that the addition of 11 districts increased the scoring range downward in the partial scores of regularity, convenience and comfort, in each case a new low being created. It is of interest to note, however, that, in spite of the creation of new low scores, the addition of districts raised the average scores in each of these three sub-divisions. In no case, except in those mentioned, did the added districts affect range. The average scores were all changed slightly, the changes varying from increases of 1.7 in the average of scores on convenience and comfort to a decrease of 1.1 in the average of scores on quality of personnel. The

average of total scores was decreased 2.0 points from 872.0 to 870.0. The fact that the addition of eleven districts changed the averages so slightly (less than one-fourth of one per cent) was accepted as indicating that the number of observations was sufficient to give reliability to the study.

Analysis of total and partial scores. Total scores in quality of service in the 51 districts varied as shown in Table XLVIII.

TABLE XLVIII

SCORES OF QUALITY OF SERVICE, MEASURED ON THE RUEGSEGGER SCALE, IN 51 CENTRAL DISTRICTS

Class Limits	Number of Districts	Average of Class
799-849	13	830
850-899	18	874
900-949	12	913
950-999	2	957
Low Score	799	Mean Score 870
High Score	964	Median Score 867

The scores varied from 799 to 964 with an average of 870. The fact that the mean and median scores are so close indicates a relatively even distribution of scores, with a few more schools below the average than above. The Ruegsegger Scale has not been widely used, so it may be said that no normal score, against which

the schools of this study can be compared, exists. The scores are believed generally to be high, however, reflecting the high standard of equipment and service found in New York State. A better understanding of total scores and their distribution is gained by examination of the partial scores recorded in the six divisions of the scale and in their sub-divisions.

Regularity of service. The summary of scores under Regularity of Service and its sub-divisions is shown in Table XLIX. The method of scoring will be given only scant description here, because it is fully explained in the copy of the Ruegsegger Scale in the appendix. The reader is urged to examine this carefully, a knowledge of the method of scoring being essential to interpretation of the scores.

The total scores under regularity of service varied from 102 to the perfect score of 135, with an average of 128. The general excellence of service, with regard to regularity, is attested by the fact that only four of the 51 districts were given a score of less than 120 and by the fact that 10 districts received perfect scores. Analysis of these scores requires examination of the sub-divisions under Regularity.

TABLE XLIX

REGULARITY OF SERVICE, MEASURED BY THE RUEGSEGGER SCALE, IN 51 CENTRAL DISTRICTS

Class	Number of Districts	Total Regularity 135*	Trips Made 40	Trips on Time 50	Trips by Regular Driver 25	Trips by Regular Bus 20
100-109	1	102	39	41	22	0
110-119	3	117	40	48	18	17
120-129	21	124	39	45	20	19
130-135	26	133	40	50	24	20
Low Score		102	36	40	9	0
High Score		135	40	50	25	20
Mean Score		128	40	48	22	19
Number of Perfect Scores		10	43	26	12	43

*Possible score

Percentage of trips made. A perfect record of trips made is given a score of 40 with a deduction, from the possible score, of 4 for each per cent of trips missed because of break-down in equipment or inclement weather, school being in session at the time. Scores in the 51 districts ranged from 36 to 40 with an average of 40 (computation being to the nearest integer). Forty-three of the 51 districts received perfect scores. The low score of 36 indicates that in one district one per cent of the total trips were missed. Assuming a school year of 190 days, each day represents .5-% of the year's operation. One per cent of total trips, then, means an average of two days' operation per bus missed in the low score district. The average score of 40 indicates an average of less than 1/8 of one per cent missed for all districts.

Percentage of trips on time. A perfect record of all trips made on time is given a score value of 50 in the Ruegsegger Scale, with a deduction of 5 points made for each per cent of trips made late. In this subdivision, scores for the 51 districts varied from 40 to the perfect score of 50, with an average of 48. Twenty-six, or half, of the districts achieved perfect scores. The low score of 40 indicates that, in the low score

district, busses were late 2% of the time, an average of 4 times yearly for each bus. The average score of 48 shows an average number of tardy trips per bus per year of less than one.

Percentage of trips made by regular driver. A perfect record of trips made by the regular driver was given a score of 25 with a deduction of 4 points made for each one per cent of trips made by a substitute driver. The use of a substitute driver does not assure inferior service, but too frequent a use of substitutes indicates unsettled conditions not desirable. The scores in this section ranged from 9 to 25 with an average of 22. Twelve schools went through the year without the use of a substitute. The average of 22, off 3 points or 12% from the perfect score, indicates that the schools were weakest in this subdivision under regularity. The low score of 9 shows that in one district substitutes were used 4% of the time or an average of 8 days per bus. The average of 22 shows a use of substitute drivers for an average of one and a half days yearly for each bus.

Percentage of trips made by regular bus. The perfect score in this sub-division, given in those cases where all trips are made by the bus regularly

assigned to the route, is 20, with a deduction of 4 points being made for each per cent of trips made by a substitute bus. The scores in the 51 districts ranged from 0 to 20 with an average of 19. This range of 20 points is the widest recorded in any of the sub-divisions under regularity of service, but the high average of 19 shows the zero score to be unusual and that little use of substitute of substitute busses is to be expected. Forty-three of the 51 districts used no substitute busses. The average score shows the use of a substitute bus for one trip (morning or afternoon) annually for each route.

Significance of scores on sub-divisions under regularity of service. The scores on regularity of service varied from 102 to 135. A review of the scoring of the sub-divisions shows which of these are of greatest significance to total score under the heading of regularity. Percentage of trips made and percentage of substitute busses used show fewer variations from the perfect score and those within a narrow range (excepting the one apparently unusual score under percentage of substitute busses used). Percentage of trips on time, however, and percentage of trips by substitute drivers show greater frequency in

variation from the perfect score and greater range in such variation. To these two sub-divisions most of the variation in the total regularity score can be traced.

Convenience of service. Convenience to the pupil in transportation service is measured, in the Ruegsegger Scale, in terms of the distance pupils have to walk, the time they are required to wait for the busses, and the time they are on busses in traveling to and from school. A summary of the scores on convenience of service for 51 central districts is given in Table L.

Scores varied from 73 to 120 with an average of 108. But one district achieved a perfect score. The wide range in score indicates significant differences in policy with regard to the provision of service convenient to the pupil but it is observable that only eight of the districts received a score less than 100 with the average of 108 representing a high degree of convenience in the transportation service provided. Study of the variations in the elements that make up the convenience score is essential to an understanding of the score itself.

Percentage of pupils walking. This sub-division deals with the distance pupils are required to walk

TABLE L

CONVENIENCE OF SERVICE, MEASURED BY THE RUEGSEGGER SCALE, IN 51 CENTRAL DISTRICTS

Class	Number of Districts	Total Convenience 120*	Pupils Walking 35	Pupils Waiting 30	Time on Bus 35	Pupils Transported 20
70- 79	1	72	0	17	35	20
80- 89	2	86	34	0	33	20
90- 99	5	95	20	24	32	18
100-109	12	104	27	28	31	18
110-120	31	115	33	29	33	20
Low score		72	0	0	21	10
High score		120	35	30	35	20
Mean score		108	30	27	32	19
Number of Perfect Scores		1	10	35	8	45

*Possible score.

from their homes to the bus. A perfect score of 35 is granted in those cases where no pupils walk over a quarter of a mile. Deductions are made for the percentage of pupils walking over that distance. The scores varied from 0 to 35 with an average score of 30. Ten schools had a perfect score. The various combinations of distances and penalty deductions make it impossible to interpret these scores in terms of pupils and distances exactly but the general high quality of average performance is realized when it is understood that the average score of 30 would be achieved in a district where only 8 per cent of the pupils walked over a quarter of a mile to the bus, none of them walking over half a mile.

Percentage of pupils waiting. Percentage of pupils waiting refers to those situations where busses make more than one trip and pupils are required to wait, after school is dismissed, for a bus to make its second trip. The scores varied from 0 to 30 with the high average of 27. Thirty-five of the 51 districts had perfect scores. High standard of service is indicated by the fact that the average score means that but 10% of the pupils wait for busses, none over 20 minutes.

Average time on bus. The average time spent by

pupils on busses is, in the Ruegsegger Scale, given ideally as less than 20 minutes, with a point score of 35 given for that condition. An average time of from 20 to 40 minutes is scored 30 points; 41 to 60 minutes 15 points; more than an hour 5 points. Scores for the section ranged from 21 to 35 with an average of 32. Eight districts achieved the perfect score. The low score of 21 indicates that, in the low scoring district the average time spent by pupils on busses was less than 40 minutes. The average score of 33 indicates the average time for all districts to be less than 20 minutes.

Pupils transported. This sub-division under convenience refers to a measurement of the area around the school within which pupils are not transported. Scores varied from 10 to 20 with the high average of 19. The low score shows that no school refuses trahsportation to pupils who live a mile or more from the school. The average score of 19 indicates the general acceptance of lesser limits, the usual situation being that all pupils not living in the central village are transported.

Significance of part scores under Convenience to the Pupil. The total scores on convenience to pupils ranged from 72 to 120. Variations in score seem to rise

chiefly out of variations in the part scores of percentage of pupils walking and the percentage of pupils waiting. The first of these showed a range of 35 points and a fairly constant relationship to total scores, with but 10 districts showing maximum scores. The second shows a range of thirty points, also showing relationship to total scores, but with 35 districts showing perfect scores. Only 8 schools achieved perfect scores in the section on time spent on bus and the section showed a range of 13 points, but there seems little relationship between the scores in this section and total convenience scores. The same is true of pupils transported, a section in which 46 of 51 schools received perfect scores.

Comfort of pupils. The division on comfort in the Ruegsegger Scale measures the provisions made for the comfort of pupils in terms of the percentage of crosswise seats, the percentage of seats padded, the percentage of bodies meeting present state regulations and the degree of overloading. As shown in Table LI, the scores ranged from 83 to 110, with an average of 103. Sixteen schools achieved the perfect score. Significant causes for this variation are discoverable by examination of the sub-divisions under comfort.

TABLE LI

PROVISION FOR THE COMFORT OF PUPILS, MEASURED BY THE RUEGSEGGER SCALE, IN 51 CENTRAL DISTRICTS

Class	Number of Districts	Total Comfort 110*	Crosswise Seats 25	Padded Seats 25	Bodies Meeting State Standards 30	Overloading 30
80- 89	4	85	25	25	28	5
90- 99	9	95	24	25	26	20
100-110	22	105	25	25	30	25
120	16	110	25	25	30	30
Low Score		83	21	25	15	0
High Score		110	25	25	30	30
Mean Score		103	25	25	29	24
Number of Perfect Scores		16	44	51	48	19

*Possible score.

Percentage of crossing seats. The New York State Department of Education now requires that only busses with forward facing seats be purchased. Of the busses purchased before the passing of this regulation, a few with longitudinal seats still remain, Scores in this sub-division ranged from 21 to 25 with an average of 25. Forty-four schools had perfect scores. The passage of time assures that scores in this section will become automatically perfect.

Percentage of padded seats. The seats in school busses in New York State are required by regulation to be padded, the score for all busses and all districts automatically 25, the perfect score.

Percentage of bodies meeting state regulations. The constant raising of state standards for school bus equipment, not retro-active, means the existence in use, at any given time, of some busses that do not meet the regulations of that time. The amount of lag depends on (1) the rapidity of change in minimum standards and (2) the number of busses that meet only the minimum standard at time of purchase. The scores in this sub-section ranged from 15 to 30 with the high average of 29. Forty schools achieved perfect scores. The probable explanation of so high an

average score lies in the general purchase of equipment in excess of the minumum requirements of the state.

Percentage of overloading. Of greatest significance to the variations in total score under comfort are the variations in score under the sub-division dealing with the degree of overloading of busses. The scores varied from 0 to 30, with an average of 24. Nineteen of the districts reported perfect scores. The section indicates the prevalence of a degree of overloading. Such overloading, of course, may not exceed the overload of 15% of rated seating capacity permissable under the ruling of the New York State Public Service Commission.

Significance of partial scores under the heading of comfort. Total scores under comfort varied from 83 to 110. This variation of 27 points was due only in slight degree to the presence of longitudinal seats or to the persistence in use of bodies that fail to meet state regulations and not at all to the presence of unpadded seats, there being none of these. All significant variations in comfort arise out of the degree of overloading, scores in this sub-section showing a range of 30 points, from zero to 30, with only 19 of 51

schools showing no deviation from the possible score.

Security of the pupil. Security to the pupil in the Ruegsegger Scale, is measured in terms of the number of accidents to pupils, bodily injury insurance carried, supervision of the route, the presence of hazards on the route and the provision for first aid to injured pupils. The scores on security ranged from 135 to 200 with an average of 162. But one school achieved a perfect score. A summary of the scores on comfort and its sub-divisions is shown in Table LII. Of greatest significance to variations in these scores are the variations in the sub-section on supervision of route, on the existence of hazards, and on first aid provisions, as is shown in an analysis of the scores.

Percentage of pupils injured. The excellent record of New York school bus transportation, with regard to accidents, is exemplified by the fact that in one school year and in 51 districts but seven accidents were reported, only one of which required the services of a physician. Scores varied from 63 to 65, with an average of 65. Forty-four schools reported perfect records, or no accidents.

Insurance carried. The Ruegsegger Scale gives a

TABLE LII

PROVISION FOR THE SECURITY OF PUPILS, MEASURED ON THE RUEGSEGGER SCALE, IN 51 CENTRAL DISTRICTS

Class	Number of Districts	Total Security 200*	Pupils Injured 65	Insurance Carried 40	Supervision of Routes 30	Hazards on Route 40	First Aid Provision 25
130-139	2	137	65	40	5	15	13
140-149	6	147	65	40	7	21	16
150-159	16	154	65	40	3	33	12
160-169	16	164	65	40	10	35	15
170-179	5	174	65	40	10	37	22
180-189	3	183	65	40	23	36	19
190-200	3	197	65	40	30	37	25
Low Score		135	65	40	0	5	10
High Score		200	65	40	30	40	25
Mean Score		162	65	40	9	32	16
Number of Perfect Scores		1	44	51	6	10	10

*Possible score.

perfect score of 40 to those districts that carry the insurance required or recommended by the state. A bodily injury coverage of $5000/50,000 for medium size busses is required in New York State. No school carries less than this; most carry more, as is shown in Table XXXI. The scores for each of the 51 districts studied was, therefore, 40.

Supervision of routes. Supervision, in this section, refers to the riding of a route by a competent agent to supervise the management of pupils and the characteristics of the route. Sixteen districts reported no such supervision; 29 districts reported each route supervised annually but not as frequently as monthly; six districts reported each route supervised monthly. The scores ranged from 0 to 30 with an average of 9, indicating that the average of all districts is supervision of the routes something less than one annually.

Hazard on route. The measurement of hazards (see definition of hazard in the copy of the Ruegsegger Scale in the appendix) on a route is recorded by deductions from the perfect score of 40, given to the route on which no hazard exists. Scores in this sub-section varied from 5 to 40, with an average

of 32. The low score indicates that, in the low score district, an average of more than four hazards per route were found. The average score of 32 districts indicates an average of a little more than one hazard per route. The scoring on hazards brings up two problems: (1) the fact that, in spite of careful definition, the measurements of hazards is at least partly subjective; and (2) the question as to whether a district should be penalized in scoring for the existence of hazards when, by careful operation, it avoids accidents.

First aid provisions. Under the sub-section on first aid provisions, each district is awarded 10 points for the provision of first aid equipment with additional points up to 15 allowed, dependent on the percentage of drivers trained in first aid skills. The provision of first aid equipment on each bus is mandatory in New York State. Scores, then, ranged from 10 to 25 with an average of 16. Ten schools had perfect scores, that is, had all of their drivers trained in first aid. The average score of 16 shows that 40% of all of the drivers in 51 districts had received first aid training.

Significance of partial scores under security.

Total scores under security varied 65 points from 135 to 200. Contributing to this variation are the variations in the scores of supervision of the route, with a range of 30 points, hazards on the route, with a range of 35 points, and provisions for first aid to injured pupils, with a range of 15 points. The number of injuries to pupils contributed very little to the variation in security score, insurance carried nothing at all.

Conveyance. The quality of the conveyance used in transportation contributes directly to the quality of service rendered. Inadequate equipment, or adequate equipment maintained in ineffective fashion, leads inevitably to inadequate service. The Ruegsegger Scale measures the selection of equipment in terms of weight capacity and of purchase and present value, and measures its effective use in terms of capacity utilization, inspection, housing and servicing. Scores on conveyance in the 51 districts studied, varied from 134 to 225, with an average of 196. Table LIII shows the distribution of scores in the measurement of conveyance and the part scores in its sub-divisions. Examination of the sub-scores indicates the factor as significant to variations

Class	Numbe Distr	requency of upervision
130-139	2	20
150-159	1	20
170-179	6	20
180-189	8	20
190-199	8	20
200-209	10	20
210-219	12	20
220-225	4	20
Low Score		18
High Score		20
Average Score		20
Number of Perfect Scores		49

*

in the conveyance score.

Weight capacity. Weight capacity, the chassis weight per rated pupil capacity, an indication of the adequacy of equipment selected, is, in the Ruegsegger Scale, scored as follows:

Weight per pupil place	Score
101-125 lbs.	25
126-150	25
75-100	15
Over 150	15
Less than 75	5

Scores varied from 15 to 25, with an average of 25. The high average must be attributed to the fact that the selection of busses is subject to approval by the State Department of Education, and approval is withheld if excesses in weight in either direction is apparent.

Average load. Utilization of rated seating capacity is scored, in the Ruegsegger Scale, as follows:

Utilization	Score
91-100%	25
76-90%	15
50-75%	5
Less than 50%	0

Scores in this section varied from 5 to 25, with an average of 21. Thirty-three of the 51 districts reported 100% utilization. The low score of 5 shows one school to be using less than 75% of its seating capacity. The average score of 23 cannot be interpreted in terms

1/See appendix, Ruegsegger Scale, p.78.

of percentage utilization because utilization over 100% is not scored. The actual average for all district was over 100% utilization.

List price. In the Ruegsegger Scale, the purchase price of vehicles per rated seating capacity is included as a measure of quality, assuming that more expensive busses are better busses. 1/ The method of scoring follows.

Purchase Price	Score
Above $75	25
51-75	15
26-50	5
Less than 25	0

Scores varied from 15 to 25 with an average of 25. Forty-eight of the 51 districts reported a perfect score, that is, a purchase price for busses averaging over $75 per pupil place. In no case were purchase prices less than $50 per pupil place reported.

Present value of vehicles. The present value of equipment, depending on purchase price and age, and used as a measure of quality, was determined by allowing 12½% depreciation annually. It is scored as follows:

Present value per place	Score
Above $75	20
51-75	15
26-50	10
Less than 25	0

1/See appendix, Ruegsegger Scale, p.76.

Scores varied from 0 to 20, with an average of 13. Eight districts were scored 25, showing their equipment to have a present value of more than $75 per pupil place.

Effectiveness of brakes. Effective brakes, of utmost importance to safe driving, was measured in terms of the distance required to stop busses moving at 20 miles an hour.

Stopping distance	Score
20-30 feet	35
Less than 20 feet	30
Less than 30 feet	5

All busses are inspected at least four times annually by the agents of the Public Service Commission, the requirement of the commission being that busses, traveling at 20 miles an hour be stoppable in 22 feet. Busses requiring more than that distance to stop are not permitted to remain in service. Scores in this section varied from 30 to 35, with an average of 34. Forty-one schools reported a perfect score.

Frequency of inspection. Inspection, an item in the effective maintenance of busses and in safe travel, is scored from 5 to 30 in the Ruegsegger Score Card.

Frequency of inspection	Score
Weekly	30
Twice a month	25
Monthly	25
More than weekly	20
Less than monthly	5

Scores in this section varied from 5 to 30, with an average of 22. The low score, 5, reported by six districts, indicates no inspection other than that by the state inspector. Twenty schools reported inspection as often as once a month.

Method of housing busses. Effective housing is essential to effective operation of busses. Classified according to the provision of or lack of heat according to ownership, housing facilities are rated in the manner shown below.

School owned garage	Score
Heated	20
Unheated	10
Private garage	
Heated	15
Unheated	5

The scores varied from 5 to 20 with an average of 15. Nineteen districts reported the maximum score, indicating that they stored all of their busses in school owned, heated garages.

Servicing of busses. On the assumption that, where servicing is done by school hired mechanics, it is more promptly and efficiently done, the Ruegsegger Scale values such servicing by a point score of 25, servicing by outside agents being valued at 15 points. Scores

in this section ranged from 15 to 25, with an average of 20. Twenty-eight districts reported all servicing done by school hired mechanics.

Suspension of busses. The suspension of busses from service by the state inspectors is an indication of inadequate inspection and maintenance. Scores varied from 18 to 20, with but two districts reporting variations from the perfect score. Several districts reported the discovery, by state inspectors, of minor defects in equipment, all of which were remedied immediately and the busses approved by service. The fact that such defects existed for discovery by state inspectors, however, is an indication of inadequate inspection by local agents.

Significance of part scores under conveyance. Scores on conveyance varied from 134 to 225, a range of 91 points. A review of the sub-divisions under conveyance show that, of the nine sections, four were of comparatively little significance as contributors to variations in the total conveyance score.

1. Weight capacity per rated seating capacity, with a range of 10 points, but with only 2 districts out of 51 varying from the perfect score of 25, is relatively unimportant in its significance to the conveyance score.

2. Purchase price of conveyance, with a range of 10 points, but again with a minimum

number of variants (3) from the perfect score of 25, seems also to contribute little to tht eotal variation in the conveyance score.

3. The braking power of busses, measured in terms of stopping distance, with a range of but 5 points, and with 41 or the 51 districts awarded perfect scores, seems of little significance.

4. Suspension of busses with a scoring range of 2 only, and with two districts of 51 showing a defection from the possible 20 point score, contributed almost nothing to the variation in total score.

The significant sources of variation in the conveyance score are to be sought in the remaining five sub-sections.

1. Average load, with a range of 20 points, and with 18 districts varying from the possible score of 25, was of medium importance in its significance to total score under the heading of conveyance.

2. Present value of equipment, also with a range of 20 points, but with 43 of the 51 districts scoring less than the maximum score of 20, is a major contributor to variations in the total score.

3. The frequency of inspection of busses showed a wide variation (20 points) in score with 31 of 51 schools suffering deductions from the possible score, thus contributing heavily to variations in the conveyance score.

4. Housing, with a variation of 15 points, and with 32 of 51 schools receiving less than the maximum 20 points, must also be considered a heavy contributor to total variation.

5. The method of servicing, with a variation of but 10 points, but with 31 variants from the perfect score, also is significant in its relation to conveyance score.

The closeness and the consistency variations in score of the last three variants to the variation in total conveyance score of particularly noticeable. It is of interest to note, also, that better scores could probably be gained in these three items without material increase in costs.

Quality of operating personnel. In school bus transportation, a high quality of driver personnel is an essential to both security and regularity of service. The Ruegsegger Scale measures the quality of drivers in terms of sex, age, experience, occupation, length of service, wage, physical condition, and character. In 51 central districts, the scores on personnel varied from 135 to 201, with an average of 173. The distribution of scores on driver personnel, and the scores of the eight elements that make up the personnel score, are shown in Table LIV. To determine the significant sources of the variation of 66 points in score, examination of the separate subdivisions is necessary.

Sex of driver. The Ruegsegger Scale gives male drivers a point score of 15 as against a score of 5 for female drivers on the ground that a man's greater physical strength makes him more effective in

Class	on Character of Drivers 25
130-139	40
140-149	42
150-159	39
160-169	42
170-179	42
180-189	42
190-199	41
200-210	44
Low Score	31
High Sco	45
Mean Sco	41
Number o Scores	3

emergencies and in making minor repairs on the road. In the fifty-one districts, operating 324 busses, but two women drivers were found. Scores varied from 17 to 20, with an average of 20, and with only two districts showing deviation from the perfect score.

Age of drivers. The score value given age catagories in the Ruegsegger Scale is as follows:

Age	Score
Under 18	0
18-20	10
21-30	20
31-55	25
56-65	10
Over 65	0

Regulations of the State Department of Education of New York State do not permit the use of drivers under 21 years of age, so that the first two classifications have no application to this study. The scores of the 51 districts varied from 15 to 25 with an average of 23. Twenty districts reported a score of 25, all of their drivers being within the 31-55 age group.

Previous experience of drivers. Previous experience in this section is defined as experience in commercial driving of trucks, busses or taxis prior to the time of employment by the school district involved. Experience in years is valued as follows:

Experience	Score
More than 5 years	30
2-5	25
1-2	20
Some--less than 1	10
None	0

Scores in 51 districts varied from 0 to 30, with an average of 23. Seven schools reported all of their drivers as having more than 5 years experience. The average of 23 indicates an average experience of from 2 to 5 years.

Occupation of drivers. School bus driving is in general a part-time job, the drivers usually being employed in some capacity, during the hours when not driving, either by the school authorities or in some outside employment. This section measures the value to driving service of non-driving occupations, the occupations being scored as follows:

Occupation	Score
Mechanic drivers	20
Other drivers	15
Janitor drivers	10
Teacher drivers	10
Student drivers	5

Student drivers are not permitted in New York State (see age situation, page 182) and the use of teachers as drivers, while not forbidden, is discouraged. The scores varied from 10 to 20, with an average of 15.

Such an average indicates that the number of mechanic drivers must just offset the number of janitor drivers.

Length of service of drivers. Permancy of service is not direct assurance of superior driving. It does, however, indicate acquaintance with routine and with pupils, and a generally satisfactory employment relationship that assures a smoothly functioning organization. The score value attributed to length of service, in years, follows:

Length of service	Score
Continuous	25
More than 5 years	25
3-5	20
2-3	15
1-2	10
Less than 1	5

Scores varied from 8 to 25 with an average of 21. Nine schools had a score of 25. The surprisingly low score of 8 occurred in a district where drivers had engaged in a strike for higher wages, all but the chief driver being replaced at mid-year. The average score indicates an average term of service over 3 years.

Wages of drivers. Wages of drivers, in the Ruegsegger Scale, is, like the price of busses (see page 154), used as a measure of quality on the assumption

that a higher wage rate will attract superior people into employment as bus drivers. The score value given various levels of wage varies from 5 to 20.

Wage per day	Score
More than $4	20
$3-$4	20
$2-$3	15
Less than $2	5

Scores varied from 15 to 20, with an average of 18. Twenty-nine schools reported the maximum score of 25, indicating a wage rate for all drivers in those districts of $3 or more.

Physical examination of drivers. A physical examination of drivers may be a means of preventing accident or generally inferior service due to physical defects on the part of the driver. The Ruegsegger Scale gives a 25 point score where drivers are examined annually, 15 points where they are examined at the time of employment, and a zero score where no examination at all is given. Scores for the 51 districts varied from 0 to 25, with an average of 11. Twenty-six, or half of the schools, reported that they required no physical examination of bus drivers. Sixteen schools had all drivers examined annually.

Character of drivers. School bus drivers, in their work, are in constant contact with children and

for that reason should be as carefully selected, from the viewpoint of character, as are teachers. The Ruegsegger Scale rates nine characteristics of drivers, giving each a scoring range of 6 points, from 0 to 5. The nine characteristics are attire personal cleanliness, clean speech and expression, freedom from objectionable habits, sobriety, wholesome temperament and attitudes, courtesy and friendliness, ability to maintain discipline, and general moral uprightness. The scoring of these characteristics is admittedly subjective. Scores ranged from 31 to 45, with an average of 41. It is interesting to note that three scorers rated all of their drivers perfect in all nine characteristics.

Significance of part score under driver personnel. The scores on driver personnel ranged 66 points from 135 to 201. Review of the sub-divisions under personnel reveals that sex of driver, with a range of but 3 points, and drivers' wage with a range of 5 points only are not serious contributions to the variations in the personnel score. The remaining elements, with range and number of variations from the perfect score reviewed below, contribute significantly to the total variation.

	Scoring Range	Number of variations from the perfect score
Age of driver	10	31
Experience	30	44
Occupation	10	50
Length of service	17	42
Physical examination	25	35
Character	14	48

Significance of the major divisions of the Ruegsegger Scale to total quality score. The last several pages have been devoted to an examination of the elements of quality as measured by the Ruegsegger Scale and of the scoring significance of those elements to the six major divisions of the scale: regularity of service, convenience, comfort, security of the pupil, the quality of the conveyance, and the quality of driver personnel. It is interest next to examine the major divisions in their relationship to the total quality score and to discover which of these are of greater or less significance in their contribution to variations in the total quality score. Table LV shows the 51 districts grouped according to total score with the average score of each group in each of the major sub-divisions of the scale.

Examination of the table shows some sections of more and some of lesser significance in their contribution to total score.

TABLE LV

RELATIONSHIP BETWEEN TOTAL QUALITY SCORE AND THE SCORES OF THE MAJOR DIVISIONS OF THE RUEGSEGGER SCALE, IN 51 CENTRAL DISTRICTS

Number of Districts	Total Score	Regularity of Service	Convenience of Service	Comfort	Security	Quality of Conveyance	Quality of Personnel
13	823.5	124.2	106.6	100.4	157.5	174.3	160.5
13	852.3	127.6	102.1	103.9	153.2	198.8	166.8
13	885.6	130.8	110.0	100.8	160.6	202.7	179.9
12	922.4	130.7	114.7	107.1	177.6	207.6	184.8
Low Score	799	102	72	83	135	134	135
High Score	964	135	120	110	200	225	201
Mean Score	872.0	129.2	110.3	104.7	162.0	194.9	171.6
Number of Perfect Scores	0	10	1	16	1	1	0

1. Regularity of service, with 10 districts achieving perfect records, with the relatively narrow range of 23 points, and with an average score but 5.8 points below the maximum score, is of relative unimportance to the variation in total score. The consistency of its relationship to total score is, however, marked.

2. Convenience of service with a range of 48 points, an average of 9.7 points below the possible score, and with 50 of 51 schools showing variation from the possible score, is of medium importance to total score. The inconsistency of the relationship between convenience and total scores suggests that the conditions of distance walked and time spent waiting for busses (the significant elements under convenience, see page 145), are not markedly different in high and low score districts.

3. Comfort, with the narrow range of 27 points, with an average but 5.3 points below the possible maximum, and with 16 schools reporting the maximum score, is, like regularity of service, relatively inconsequent in its contribution to variations in total score.

4. Security, with a range of 65 points, with an average 38 points below the perfect score, and with

but one school scoring perfectly, is a major contributor to variations in total quality. The consistency of relationship between the security score and total score is marked.

5. The quality of the conveyance also proved to be a source of significant variations in total score. But one school received the maximum score; the range in score (91 points) is the widest of any of the divisions of the scale, and the average score is 30.1 points below the possible score. As in the case of security, its consistent relationship to total score is noticeable.

6. Quality of driver personnel is also a heavy contributor to the variations in total score. No school was rated perfect in this classification; the average was 38.4 points less than the maximum score; and the range of 75 points was second widest of all the divisions. Again, the relationship to total score is markedly consistent.

Relationship between quality and cost of transportation. One of the expressed purposes of this chapter is to discover any possible relationship between the cost of transportation and its quality as measured by the Ruegsegger Scale. Forty-five of the 51

districts scored for quality presented per pupil costs of transportation.

TABLE LVI

THE COST OF TRANSPORTATION PER PUPIL TRANSPORTED IN 45 CENTRAL DISTRICTS

Class	Number of Districts	Number of Busses	Average cost per Pupil Transported
$10-$19	3	14	$15.69
20- 29	8	51	25.31
30- 39	13	90	35.66
40- 49	11	72	45.95
50- 59	6	46	53.02
60- 69	4	21	65.78
Low Cost	$14.00	Mean Cost	$40.00
High Cost	68.36	Cost Range	54.36

Cost per pupil transported, in the 45 districts advancing information on this point, varied from $14.00 to $68.36 with a mean cost of $40.00. So wide a variation is hardly explainable in terms of the cost factors dealt with in Chapter IV, though these, of course, contribute. Possible factors in the variation of costs, not heretofore considered, are the quality of the service rendered and the advantages of utilization and superior management accruing to some schools through the operation of large fleets. The relationship between cost and quality of transportation, as expressed in the Ruegsegger Score, is shown in Table LVII.

The table shows no positive relationship between per pupil costs and quality of transportation, appearing

TABLE LVII

RELATIONSHIP BETWEEN COST PER PUPIL TRANSPORTED AND RUEGSEGGER SCORES OF QUALITY IN 45 CENTRAL DISTRICTS

Cost per Pupil	Number of Districts	Number of Busses	Ruegsegger Score of Quality
Below $30	11	65	875.7
$30-$39	13	90	877.4
40- 49	11	72	869.5
$50 or more	10	67	866.3

to suggest, in fact, a slight negative relationship, the increase in per pupil costs of $35.44 (the difference between the average costs of the first and last groups) being accompanied by a net decrease in quality score of 9.4 points. This obviously illogical relationship may be due to a failure to select a valid measure of costs or a valid measure of quality. On pages 32-34 reasons were advanced for believing that per pupil costs of transportation do not provide a valid unit for the measurement of need nor for making comparative studies in cost. The seat-mile was suggested as a more useful unit of measure. Any relationship found to exist between quality and total seat-mile costs would, however, be false in nature

because cost of bus, insurance costs and drivers' wages, items in total costs, are also items in the quality measure. Operating costs per seat-mile, logically affected by the quality of transportation, offer a more usable measure. Quality scores and operating cost per 1000 seat-miles were available for 40 districts.

TABLE LVIII

RELATIONSHIP BETWEEN OPERATING COST PER 1000 SEAT-MILES AND QUALITY SCORES IN 40 CENTRAL DISTRICTS

Operating Costs per 1000 Seat-miles	Number of Districts	Number of Busses	Quality Score
Under $.80	8	44	881
$ .80 - .99	8	50	866
1.00 -1.19	8	50	874
1.20 -1.49	8	56	870
1.50 or more	8	4.	868

The data in Table LVIII fail to show any relationship between the operating costs per seat-mile and the quality of service as measured by the Ruegsegger Scale.

It was suggested on page 171 that size of fleet may have an effect on costs or on the quality of transportation. The following table shows the relationship between per pupil costs, quality score and size of fleet in 45 districts.

Table LIX shows no existing relationship between size of fleet and costs per pupil. It does show, however,

TABLE LIX

RELATIONSHIP BETWEEN SIZE OF FLEET, PER PUPIL COST OF TRANSPORTATION AND QUALITY OF TRANSPORTATION IN 45 CENTRAL DISTRICTS

Size of Fleet	Number of Districts	Cost per Pupil	Quality Score
2-5	14	$34.64	862
6	14	44.81	874
7-8	9	41.88	876
9 or more	8	38.82	863

a positive and rather consistent relationship between size of fleet and quality of transportation indicating that large fleets make possible management practices that effect a higher quality of transportation.

Because of distrust of per pupil costs as a unit of measure, relationship between size of fleet and costs were sought also by using operating costs per seat-mile as the cost measure.

TABLE LX

RELATIONSHIP BETWEEN SIZE OF FLEET OPERATING COST PER 1000 SEAT-MILES, AND QUALITY OF SERVICE IN 40 CENTRAL DISTRICTS

Size of Fleet	Number of Districts	Operation cost per 1000 SM	Quality of Service
2-4	9	$1.417	858
5	8	.923	866
6	10	1.334	878
7-8	6	.963	885
9 or more	7	1.395	878

Again we find no probable significant relationship between size of fleet and cost, but Table LX does show again a positive and consistent relationship between size of fleet and quality score, showing the superior management practices in effect where larger fleets are operated.

Summary. The purpose of this chapter was to analyze the quality of transportation in selected districts using the Ruegsegger score card, and to seek to discover any existing relationship between cost and quality. In summary it may be said that use of the score card made it possible to discover significant differences in the quality of transportation and to discover in what elements of quality these significant differences occurred with greatest frequency. The total scores were generally high, reflecting a high standard of bus transportation. The most frequent and the widest deviations from the ideal occurred in those major divisions of the scale dealing with security, quality of conveyance and quality of driver personnel, the other three divisions, regularity, convenience, and comfort showing fewer variations and those over a narrower range.

Within the six divisions, certain elements stood

out as contributing most heavily to variation in the division scores. Under regularity, late trips and use of substitute drivers were most significant; under convenience, the distances pupils were required to walk and the average time on busses; under comfort, overloading; under security, supervision of the route, hasard on the routes, and provisions for first aid; under quality of conveyance, present value, frequency of inspection, housing and servicing; and under quality of personnel, experience of drivers, occupation of drivers, and physical examination of drivers. This is not to imply that the items listed are of greatest importance. They are those which, in the 51 districts studied for quality, showed practice deviating most frequently and most widely from the ideal.

The study failed to show any relationship between the cost and the quality of transportation. This should not be accepted as conclusive evidence of a lack of such a relationship. There are a number of possible reasons for non-success in the effort to discover it.

1. The wide variation of costs due to managerial practices, so noticeable in all items of cost discussed in Chapted IV, and which were assumed to conceal the effect of factors underlying costs,

would also operate to conceal differences in cost due to quality of transportation.

2. There is a lack of a valid unit for measuring and comparing costs in districts of widely divergent characteristics.

3. In addition to the above, it is entirely possible that where the general standard of school bus transportation is as high as it is in New York State, and where, in any significant number of the quality items measured, the deviations in practice are wholly or in large part upward from the conditions given maximum rating in the scoring system used, that relationships between costs and quality scores would be lost. These conditions existed in several items in the Ruegsegger Scale, notably in cost of busses, insurance and drivers' wages. However, when the standard of service is not maintained at high level by state requirements and when wider variations occur, it may readily be that quality and costs are related.

CHAPTER VI

SUMMARY OF PROCEDURE, CONCLUSIONS AND SUGGESTIONS FOR FURTHER STUDY

Any method of allocating state funds for transportation to school districts, based on the equalizing principle, must demand for its success in operation on the formula devised for determining reasonable costs. The writer, in his expressed purpose of devising such a formula for New York State, deviated widely in three important details from the procedure commonly followed by other students of the same subject.

The student as a measure of transportation need. In the first place, the student, as a measure of transportation needs, was unconditionally rejected. Topographical factors and the dispersion of population, with varying managerial practices, so alter the relationship between pupils transported and costs that reasonable consistency is not to be expected.

The total cost of transportation. In a second deviation from customary procedure, no attempt was made to deal with total costs per se, the approach being through the cost items and the object being to determine reasonable items of cost. The factors

underlying the cost of transportation do not affect total costs directly and, in fact, often conflict in such a way that their net effect is impossible of determination. Total costs, however, are merely the summation of the items of cost and the factors underlying costs do directly and consistently affect the cost items. Determination of reasonable items of cost, each in terms of the factors affecting it, and the summation of the items makes possible the establishment of a reasonable cost, the accuracy of which is impaired only by the characteristics of the data used for its derivation.

Characteristics of the data. Reasonable costs of many of the items of transportation costs, in this study, were derived from average practice; bus cost and interest from the average price paid for busses, rent and wages from the average cost of these items, and operating costs from the average seat-mile costs in the districts studied. The probable introduction of inaccuracies into the derived formula from this procedure is recognised. The chief characteristic of the data in all categories was the wide variation which, because it could not be accounted for in any other way, was attributed to the factor of management. The right of management to buy better equipment and

superior services should not be curtailed. The practice, clearly established in some instances, of paying out of state coffers a higher price for identical items of cost should be discouraged. In some cases of price paid, the variation of price paid was so wide as to be unbelievable; In most cases it was wide enough to cast a shadow of doubt on the reasonableness of the averages derived.

The validity of reasonable costs derived from average practice, depends, of course, not only on the characteristics of the data but also on their quality. In general, the number of observations was deemed sufficient for the calculation of reasonable costs. The section dealing with rent costs, however, is admittedly weak, the data being insufficient for accurate determination of a reasonable cost figure. It is highly probable, too, that the cost of outside housing for school busses, used in this study for predicting rent costs, is higher than school owned housing. Further study should be made of the rent item.

It may be, also, that the determination of reasonable variable operating costs lack validity because of limited data, though this is not believed by the writer to be necessarily true. When the study was organized

it was planned to allocate variable costs, reported on a fleet basis, to the busses, a lengthy procedure that set a top limit to the amount of data that could be handled, and, as it turned out, a useless procedure. It was unfortunate that the futility of the process was not foreseen. Had it been, larger quantities of data could have been handled without added labor. The characteristics of the data were such, however, (managerial variations again) that it is extremely doubtful if added data would have made more clear the effect of route factors on cost. An element of inaccuracy may have been introduced, nevertheless, by the use of the seat-mile as the variable cost unit. Whether or not, mileage being held constant, these costs vary in proportion to the number of seats is not determinable from any data at hand and needs further study.

Valuing the approach to reasonable raw cost. Characteristics and limitations of the data may have impaired to a degree the accuracy of the raw cost figures derived. Of much greater significance than the calculated averages themselves, however, is the introduction of the approach to total costs through the cost items. The method has several advantages. Attacking the smallest units of costs permits closer control

of data and permits the full inclusion into cost calculations of district and route factors whose influence on items of cost is measurable but whose net effect on total costs is impossible of calculation. To the administrator of transportation, it has further advantages. Using the resources of the method, he can fit it to his immediate situation in more exact fashion than if he were using a total cost procedure. It tells not only when his costs are high but it shows him where his costs are high. Total costs fail in this latter regard.

The quality of transportation. A third departure from the method of other studies on transportation costs was the introduction of the concept of real costs, the cost of transportation in relation to its quality, involving the measurement of quality and the establishment of its relationship to cost.

The Ruegsegger Scale. The tool used for the measurement of quality was the Ruegsegger Scale. Primarily designed as an instrument wherewith an administrator might rate his transportation practices against an arbitrary standard, it demonstrated its value to a high degree. As an instrument for comparing the quality of transportation in a number of districts, it must

be interpreted with the same reservation necessary in the interpretation of any arbitrary scale. The writer, scoring 27 districts personally, found that many of qualitative conditions rated in the scale were imposed upon the districts by circumstances beyond the control of management. The distances pupils walked and the length of routes are at least partly a function of topography. The existence of hazards on the routes were uncontrollable by management. Wage rates, at least minimum rates, were largely determined by accompanying economic factors, reflecting these as well as the quality of driver personnel hired.

In some phases, the Ruegsegger Scale failed adequately to measure conditions in New York State, where the quality of transportation is so high that deviations in practice were, in some items, as much upward from the conditions of maximum rating in the score as downward. In a few items, notably in the section on regularity of service, the writer believes the scoring should be revised to make penalties more in line with the comparative importance of derelictions in practice. For example, the omission of a trip is more serious offense against good practice than the making of it by a substitute bus, but both are given the same

penalty in scoring, and a trip made late is actually penalized more heavily than if it were omitted entirely.

In general, however, the scale is a well balanced instrument, covering a wide range of the elements of quality of service and, to the thoughtful administrator, of inestimable value in pointing out defections from ideal practice and in suggesting improvements.

The quality of transportation and costs. The study fails to establish any relationship between the quality of transportation and costs. This was not totally unexpected. The quality of transportation in New York State is so generally high and the average practice so nearly uniform that the difference may not be measurable in terms of price. Price is, of course a function of both qualitative and quantitative factors in transportation. Administrative practices in the organization of a transportation program may alter costs widely without affecting quality. For example, the utilization of busses for operation of more than one route reflects heavily in costs but may have no effect on the quality of transportation service rendered. Logically there must be a relationship between quality and costs. The difficulty lies in the devising of a

tool for measuring costs valid for purposes of comparison and in developing a method of reducing the variations in cost due to administrative practices. The field is a rich one for further investigation.

Conclusions. The purposes of this study were, as presented on pages 7 and 8,

1. To examine the costs of and expenditures for transportation in selected central districts;
2. To establish a formula or method, based on all the factors found to apply, for determining a reasonable cost of transportation; and
3. To suggest a method for distributing state aid for transportation founded on the equalization principle.

Analysis of other studies, and of the data of this study, indicated that the factors underlying costs affected total costs only indirectly and in such a way that net effect could not be measured and suggested an approach to total costs through the cost items, each in terms of the factors directly affecting it. Reasonable total costs of transportation were calculated then as the summation of:

1. Reasonable capital costs: depreciation and interest on unpaid balance of purchase price,

based on average price of busses in each size classification, purchase policy, and an estimated life expectancy, for school busses, of 10 years. This category of costs was adjusted for differences in insurance charges due to size of bus. (Page 98)

2. Reasonable contract costs: wages of drivers, insurance and rent, which were found to vary with place location, computed for each county area. (Page 114)
3. Reasonable variable costs: gas, oil, tires, chains and accessories, repairs and maintenance in terms of those factors found directly to affect them. These were days operated, length of route, size of bus, type of road and number of stops

Other factors, as age of bus, length of route as a factor in determining driver's wage, average snowfall and quality of service rendered were found not to apply. It should be noted that in other states or areas the factors found to affect costs in New York State may not be of similar significance, or that factors of no significance to cost in this state may be of significant weight elsewhere. In New York State itself

the passage of time may reduce the significance of some factors found important today while others assume positions of weight.

Distribution of state aid. The final purpose of this study was to suggest a method of distributing state aid for transportation in accordance with the equalization principle. Two criticisms were directed toward the method of distributing funds in practice prior to July, 1942 (now corrected). First the non-separation of transportation expenses from other general expense makes it possible for districts to get aid for transportation through both the transportation and the equalization quotas. Second, the match-funds basis on which aid was given favored rich districts to the detriment of those with scant local resources. To correct these two errors in method, the following is suggested:

1. That expenditures for transportation be reported separately from other expenditures for education and that they shall not be a basis for state aid through any but the transportation quota.
2. That each district be required to raise a sum of money for transportation by a .5

mill tax on real value of the district and the state contribute, as aid for transportation, a sum equal to the difference between the amount raised and the reasonable cost of transportation computed according to the method suggested in this study.

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APPENDIX

Stone Hall
Cornell University
Ithaca, New York
December 1, 1940

Dear Sir:

I am making a study of the cost and quality of transportation of school children in selected central school districts of New York State with the hope of establishing a method of determining a reasonable cost of transportation and of suggesting a method by which state funds for transportation may be distributed according to the needs of the districts. The study is being made under the direction of the School of Education at Cornell University and with the approval and help of those members of the State Department of Education who have been dealing with the transportation problem.

Your district is one of the seventy-four that, with the advice of State Department personnel, I have selected for study. I have been a central school principal and know how busy you are, and I have tried to get as much information as possible from the State Department of Education and, in fact, have already recorded considerable data regarding transportation in your district. Not all of the information I wanted was recorded in Albany, however, and some of what is recorded there was not available to me last summer when I was there.

Will you help me to the extent of filling out the inclosed short questionnaire? Some of the items listed are not "on record", I know, but I feel that with the aid of your bus drivers you can give an accurate figure for those things not a matter of record.

Your cooperation in this will be deeply appreciated by me and will help me to do a good job in what I believe to be a constructive and valuable research.

Yours truly

Name of School_____ Sheet No 194

Real value of district (1939-40)_____ Tax rate on real value (1939-40)_____

Total expenditure for transportation (1939-40)_____

Funds rec'd from the state for transportation(1940-41)_____

In the July 1940 report on transportation, you recorded a "rent" charge of $_____. Will you tell briefly what was included under this charge and how rates were established?

Please indicate under the headings listed below the use to which each bus was put in transportating children to and from school. Ignore extra trips, as athletic trips, etc. If a bus makes more than one regular trip, combine load, stops and mileage of the several trips.

Class A roads: concrete and macadam roads in good repair
Class B roads: broken macadam and good gravel roads
Class C roads: gravel roads in bad condition and dirt roads

Bus No.	Capacity	Number of trips	Av Daily Load	Number of Stops	Daily Route Mileage			
					Class A Road	Class B Road	Class C Road	Total

Stone Hall
Cornell University
Ithaca, N. Y.

Dear Sir:

You will recall filling out for me a few weeks ago a short questionnaire on transportation. This was of great help to me in that part of my study dealing with costs. A most significant part of my problem, however, deals with quality of transportation with its possible relation to cost and I wonder if you will complete your assistance to me by filling out and returning the enclosed Ruegsegger Score Card for measuring the effectiveness and quality of transportation service.

The Ruegsegger scoring system is highly objective and anyone who follows carefully the directions given in the back of the booklet will get an accurate measure of certain features of the transportation program. Measuring your program will take some little time but, if you do it, either yourself or by delegation to some competent person, you will not only help me but you may readily be doing something of value to yourself. Many administrators of transportation have found that scoring a program has suggested ways of improving it, sometimes without adding to costs.

I had wanted to send two copies of the score card to each school but the cost was prohibitive. I will, however, do what should be of greater interest. I will send you a copy of the sheet on which I summarize the reports so that you may compare your score with that of other schools. The sheet will be so prepared that no one will be able to identify your school but yourself.

If you can fill out the card and return it to me by February 15, you will, as before, be doing me a service for which I will be truly grateful. It will, I believe, be also a contribution to our understanding of professional problems.

Yours truly,

May I commend to you as a worthy project the study that Mr. Crane is making? Any help you can give will be warmly appreciated.

Director, School of Education

Stone Hall

Cornell University

Ithaca, N.Y.

Dear Sir:

I am sorry not to have heard from you in regard to the Ruegsegger Transportation Score Card sent you some time ago. I am most anxious to get a perfect or near perfect return of these because analysis of them embraces a most significant part of my study and I need a larger number of returns to make the analysis authentic.

I hope you might yet find the opportunity to fill it out or, if you are too busy, might find someone to whom you can delegate the chore. However, in case it is clearly impossible, may I visit your school some time after the spring vacation and myself score your transportation system?

This thing is truly a "must" to me and your help will be a matter of sincere thanks.

Yours truly,

PUPIL TRANSPORTATION SCORE CARD

By

VIRGIL RUEGSEGGER

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